ENGINEERING LITERATURE

M. N. Baker, Editor

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It is gratifying to note that scientific forestry in the United States has now attained sufficient prominence to seem to warrant the publication of a journal "entirely devoted to the professional or technical interests of the subject." Such a journal is the "Forestry Quarterly," two numbers of which have now appeared. The Journal is published under the auspices of the New York State College of Forestry, Cornell University, Ithaca, N. Y., but its pages are open to "all or any workers in the field for the discussion of their problems and record of their experiences." The "Quarterly" has as its "Board of Advisers" Messrs. Bernard E. Fernow and John Gifford, of Cornell, and Walter Mulford, State Forester of Connecticut. Among the papers in the first two numbers there may be mentioned one on volume tables and another on stem analyses as related to forest growths, and a paper by Professor Fernow on the "Outlook of the Timber Supply in the United States."

For the engineer just out of college the question of a working library is a serious one. Even if his means are not limited, as is quite likely to be the case, a large library might prove a serious incumbrance to one who is liable to change his residence at any time. The engineering library problem is frequently quite as serious for the older engineers as for the younger ones; in fact, if the truth were but known we fear hundreds of practicing engineers would be found without enough books to deserve the name of library. For these and other reasons we think that the enclosed inquiry raises a question which many an engineer has asked or is now asking himself:

> Sir: Kindly give a list for a working library of the best 25 to 40 books for a graduate *civil engineer* (the italics are ours). A young engineer can't buy every technical book.
>
> R. N. B.
>
> Philadelphia, Feb. 13, 1903.

The best answer to this query ought to be based upon the wide experience of many engineers, and therefore it is submitted to the readers of the Supplement with the request that lists be forwarded to the editor as soon as convenient, and that it be remembered that it is not books for specialists, but for a small library of civil engineering that are wanted.

Cement Literature.

Few materials of construction are more universally employed than cement. Consequently it is not at all surprising that inquiries for books on that material are constantly being received. From several that have come to hand since the last issue of this Supplement, we select one for publication here as representative of them all. The answer which we have attempted to give to the following letter will suffice for the others as well:

> Sir: Can you inform me of any reliable treatise giving the characteristics and properties of cements; their applicability to different conditions of use, and the methods of testing them?
>
> H. E. Eckles.
>
> Zion City, Ill., Jan. 27, 1903.

Ever since 1796, when James Parker first announced that "noddles of clay" if burned and ground to powder made a cement which "became indurated in water in the space of an hour or thereabouts," there seems to have been someone always ready with a pen to record the development of the art of manufacturing and using hydraulic cement. Our correspondents' needs can, therefore, be easily satisfied so far as quantity of written matter is concerned. Of the quality of that matter, however, we cannot speak so hopefully. There is to-day no one book in English which meets the demands of engineers for a general treatise on cements; it is doubtful indeed if any list of several books can be given which will meet these demands in all particulars.

For many years the standard American book on cements was Gillmore's "Limes, Hydraulic Cements and Mortars," and this work ($4) is today the best treatise on American natural cements which is available to the engineer, although it was published 30 years ago. The only other attempt at a book on natural cements is Cumming's "American Cements" (1898; $3). There is much information in this book concerning modern methods in the manufacture of natural cement, but as a whole the volume is untrustworthy. Mr. Cummings holds a brief for natural cement, and he argues the merits of that material both in and out of season with all the bias of a special pleader. This fault renders the book of questionable value to the general reader, and, coupled with the chemical theories and hypotheses by which the author rather loudly notes his dissent from his brother chemists, places it among the works to be accepted with caution as a guide to engineering practice.

It is only within a decade that American Portland cements have assumed commercial importance, and the books of American authorship on Portland cements are comparatively few and not of wide scope. Jameson's "Portland Cement" (1895; $1.50) is the earliest of them. It developed out of a course of lectures for college students, and naturally has all the limitations and faults as well as the merits resulting from such an origin. It is comprehensive in its scope, treating of the manufacture, properties, testing and use of cements, all within a couple of hundred pages. Spalding's "Hydraulic Cement" (1897; $2) is a more serious work, and one of wider usefulness to the practicing engineer. In fact, for a general account of the chemical composition, physical properties and testing of cements, the book is an all around good production. Like every current book which is more than a couple of years old, however, it needs revision to bring it up to date. These two are the only general manuals, of American authorship, on cements. For American practice in cement manufacture, "The Cement Industry" (1900; $3) is the only book available to the engineer. It is made up of articles which appeared first in a well-known engineering journal, and which were prepared by various authors and published at different times during several years. Each article is a descriptive account of one particular cement works, and in most cases of modern rotary kiln plants. No better account of American methods in cement manufacture is to be had.

There are perhaps half a dozen books on cements by English writers which properly come within the meaning of the term modern works. Redgrave's "Calcareous Cements" ($2.75) is one of the oldest of the lot, and in its historical matter is of particular interest. English process of manufacture and English methods of testing are, of course, chiefly treated of. There is a good chapter on slag cements, and another on various English patent cements. Directions for cement analysis and the analysis and testing of raw cement materials are given in some detail. Faija's "Portland Cement for Users" ($1), a little book of 100 pages, is chiefly interesting for the account that it gives of the well-known hot-water test and testing apparatus which bears the author's name. Heath's "Manual of Limes and Cement" ($2.50) is a less valuable book than that of Redgrave, and falls far short of Butler's "Portland Cement (1899; $6) in value to engineers. This last-named work is the most recent work of English authorship on its subject. It is essentially an account of English practice, and English processes of manufacture and testing are better and more fully treated in its pages than in any other work.

Two English books which deserve mention are Sutcliffe's "Concrete, Its Nature and Uses" ($3), and Newman's "Notes on Concrete and Works in Concrete" ($2.50). The first book is written for architects, and its author is himself an architect, and these facts, of course, influence the method of treatment. There are the usual chapters on cements and their testing, and others on water, sand and broken stone, all of a general value. The remainder of the book discusses and describes the applications of concrete to building construction. In the chapter on floors there will be found considerable information regarding early concrete-steel constructions, which is of particular historical interest in these days of reinforced concrete construction. Newman's book is designed for engineers, and it is an excellent epitome of English practice and experience in concrete construction.

We come now to a class of books in which cement is only one of the subjects treated. To this class belong Baker's "Treatise on Masonry Construction" ($5), and Johnson's "The Materials of Construction" ($6). To the engineer who wishes a practical working guide to the testing and use of cements we should recommend Professor Baker's work as preferable to any other one book. Profesor Johnson's work considers the subject of cements and concretes more in respect to their strength and physical qualities. A copy of Spald-

ing for a general discussion of cements, and Baker and Johnson for specific information in testing cements and designing and constructing in concrete will give the engineer about the best working library he can obtain, and if we throw into the balance the value of Johnson and Baker for their other contents, no better expenditure of money in cement books seems possible.

So far we have confined this review to books written in English only. To the reader of French, Candlot's "Ciment et Chaux Hydrauliques" ($4) will provide the best general treatise on cements that he can consult. In German, "Portland Cement and seine Anwendungen im Bauwesen" may be read for German practice. The list of French and German books does not need to be enlarged for the purposes of the general practitioner.

In conclusion, we wish to emphasize strongly the fact that the engineer who wishes to be conversant with the latest thought on the subject of cements must follow the periodical press carefully. The manufacture and use of cements are rapidly progressing arts, and a year or two at the most places the best text-book in the rear of the latest practice; indeed, it is only by exercising considerable activity that the periodical press keeps abreast of the advance.

CORRESPONDENCE.

The Merits and Limitations of Twelve Books of Earthwork Tables.

Sir: In your review of "The Merits and Limitations of Twelve Books of Earthwork Table," in your issue of Jan. 15, you make several statements which may lead to misapprehension.

For example, it is stated that "Johnson's, Crandall's and Hudson's tables find their greatest usefulness in three-level section work, and to a less degree in five-level section works." For three-level sections with Crandall's tables, at least for the method of averaging end areas, only one entry of the table per section is required, with width between slope stakes and center height to intersection of side slopes (from ground surface to point C in your diagram, p. 2) as arguments after the volume corresponding to the grade triangle (C E D) has been once taken out.

For five-level sections only three entries are required: Distance to slope stake and height over edge of roadbed, on the right and on the left, and width of roadbed and center height. For irregular sections an entry is required for each height given except the center height, which increases the number of entries by one only if the method is applied to five-level or to three-level ground. This gives a large percentage increase at the lower limit of three-level, but as it only calls for one entry for each triangle or trapezoid into which the section is divided, and no other method of finding accurate areas or volumes is in use, except by dividing into triangles and trapezoids, the increased labor is inherent in the cross-section and not in the table; in fact the more multiplications the greater saving in time and fatigue when the tables are once opened and in use.

Again, if a table giving areas of triangles and trapezoids, used in connection with Cross and Frost's table of cubic yards for given areas, would render the computation of irregular sections very rapid, as claimed, it is difficult to see why a table combining both in one, i. e., giving volumes direct for triangles and trapezoids like Moore's, Crandall's and Johnson's should be so ill adapted to irregular sections.

The difference between Crandall's and Moore's is exaggerated in stating that Moore's gives yardage direct while Crandall's require interpolation for tenths of fill. In the description of Moore's it is stated that widths are only given to feet while heights stop at 24.9, thus requiring interpolation for tenths of widths for all widths, and for tenths of height above 24.9 if the table is extended by multiplying by 10, while the Crandall table is extended to 100 ft. for widths and 50 ft. for heighths and the interpolations are multiplied out so that the addition for the tenths is all that is required.

In another place it is stated that it becomes absolutely necessary to plot all sections which contain more than five rod readings.

An extensive and rather varied experience in the computation of earthwork by plotting cross-sections and by computation from tables leads me to believe that wherever the side slopes are regular, the plotting of sections increases the labor several fold and diminishes the accuracy of the result if the quantities are made up by scaling the plot rather than from the actual cross-section figures. The same is true for borrow pits if properly cross-sectioned. In the case of irregular side slopes, or of a combination earth and rock cut, plotting the section will add to clearness and freedom from mistake, and in that sense it may be considered necessary.

In closing it is stated that "there are no tables giving areas for different widths of roadbed and slopes where the ground has a side slope."

It seems to me that it would be a more correct statement to say that there are at least four tables, Moore's, Hudson's, Crandall's and Johnson's, which give quantities for different widths of roadbed and slopes for three-level ground, and at least three, Moore's, Crandall's and Johnson's, which give quantities for five-level and irregular ground and that the quantities per section can be taken out with one entry for three-level, three entries for five-level, and one less entry than the number of levels for irregular ground, without having to plot the sections.

Respectfully, E. L. Crandall.

Ithaca, N. Y., Feb. 10, 1903.

(Taking the exceptions to our review in reverse order, we may say that while our correspondent's summary of four of the tables is on the whole correct, we fail to see that we should not have pointed out that "there are no tables giving areas for different widths of roadbed and slopes where the ground has a side slope." This is a fact—so far as we know—and the statement was made in direct answer to the question in a letter that first called forth our review.

It is admitted by our correspondent that the tables have to be entered three times as many times for five-level section as for three-level section work—in a word, that the labor is three-fold. It was to call attention to this fact that we said that "Johnson's, Crandall's and Hudson's tables find their greatest usefulness in three-level section work." But we had also in mind the increased difficulty of using such tables in five-level section work where the prismoid formula correction must be applied. We may go farther now and point out that where the roadbed is so wide, or the ground so irregular, that five-level sections become necessary, it is usually necessary either to take more than five levels or to take the intermediate levels, not at the angle points, but at noticeable breaks in the ground level. It has been our experience that in such cases the use of tables without plotting the sections becomes so confusing to the ordinary computer that the number of errors made far outweigh any possible gain in time saved by not plotting. It must be held in mind, as stated by another correspondent, that the computer is usually not the most highly trained man in a party—usually he is one of the least trained. Being so, it is doubly important that his work be simplified, not only that he may avoid errors, but that his errors may be quickly seen by any one checking his work. This, perhaps, explains one reason why railway engineers of long experience are apt to frown upon tables that give yardage direct, especially when such tables are used on more than three-level section work. It explains also our reason for recommending a table of trapezoid and triangle areas to be used in connection with Frost's tables of volumes. The value of such a combination is further increased where mid-sections must be plotted on irregular section work, as is the case where the prismoid formula is used.

Our correspondent's exception to our apparently unqualified approval of Moore's tables is well taken, in so far as their use for cuts of more than 24.9 ft. is concerned, but below such a cut or fill Moore's tables ordinarily require less interpolation than Crandall's.—Ed.)

Sir: The review, entitled "The Merits and Limitations of Twelve Books of Earthwork Tables," in your issue of Jan. 15, 1903, must be of timely interest to a great many locating engineers at a time when so much railroad projection is in progress.

May I respectfully call attention to what seems a somewhat curt dismissal of the very useful "Excavation and Embankment Tables and Diagrams of Trautwine's."

The purpose for which these tables have been gotten out would seem to be that of preparing close, approximate, preliminary estimates. To make a set of tables effective for this requirement, the necessary conditions are: (1) That they shall be readily understood; and, (2) that they may be rapidly manipulated. These are especially the requirements while the engineering profession is as it is in this country to-day, for our engineers may be roughly cast into three divisions: Men of high technical education and training who have almost no time to attend to estimating details; men of large experience but of small book education, who, when they are obliged to make use of technical works, require theoretical matters to be reduced to the simplest form; and lastly, that body of the profession who rely neither upon their attainments nor their experience, but upon what in many respects is better than either, their good common sense, and upon whom the detail work of preparing estimates falls.

To these latter, constituting the rank and file who must bear the burden of laborious calculation, Trautwine's Diagrams seem exactly adapted.

The art of preparing preliminary estimates lying in a rapid determination of the probable maximum cost, it is necessary to employ a method that will give at once results and a minimum of calculation. So necessary is rapidity that a method which might give exact results, though it would take only a little longer, would in most cases be discarded without consideration for the more rapid method.

Asking pardon for this preliminary, allow me to call your attention to some of the valuable points those Diagrams embrace. In the first place, your objection based upon the fact that the Diagrams are calculated for clinometer measurements of ground slope, is of no material consequence when we consider just how they are used in practice. Assuming that a contour map has been prepared, it is necessary in any case to find either the slope of the ground on the basis of a percentage or by a degree reading. In either case it is necessary to take the reading by a scale from the map. It is a very trifling matter to prepare a scale that shall give us the ground slope in degrees at once without any intermediate calculation. If a percentage basis is used it would seem to make some calculation in the reduction, which, however, is a small matter with the aid of the slide rule.

I cannot see that the reading of the degrees of slope is any more objectionable than reading it in any other way. If cross-sections are employed, conditions, however, are somewhat different, but they are not frequently made use of in preliminary estimates, and generally such employment of them is recognized as a useless waste of time. However, the degree of slope can be read from them by means of an ordinary protractor. One would think from your criticism that the diagrams could only be used for roadbeds of 14, 18 and 28 ft. I wish to call to your attention that they may be used where approximations only are required for almost any other roadbed of ordinary width. Thus, if we compare the diagrams showing the slope for a 14-ft. roadbed at 1½ to 1 and a 28-ft. roadbed at 1½ to 1 with a center height of 45 ft. and a ground slope of 20°, we will find in the one the corresponding level cutting 54.8 ft., and in the other 55.7 ft., being a difference of only 0.9 ft. in level cutting, while the roadbed is doubled in width. Thus, for all practical purposes, we may use either one of these diagrams for any intermediate widths of roadbed and feel quite sure that any error in the calculations of the earthwork may be more than compensated by other errors which it is impossible to reckon on, due to irregularities of ground surface, shrinkage, expansion, etc.

It is true that this book does not give all the tables that it should, but it is quite customary for the modern hand-book to have complete sets of tables of level cutting, in conjunction with which Trautwine's Diagrams may be used.

It may be interesting to know that in practice these diagrams work excellently; and that with two or preferably three operators—one at the map, one using diagrams and tables, and one keeping tally of the yards—the work may proceed almost as rapidly as though the ground slope was not being considered.

If there are any other diagrams more easily understood and more rapidly manipulated, it would be interesting for the profession to know of them; for any method that diminishes labor, insures correctness in the larger matters of results. For, a day is customarily appointed upon which the goods must be delivered.

Yours truly, Frank Cooper.

1129 Spruce St., Philadelphia, Pa., Jan. 26, 1903.

Sir: In looking over your recent review of tables for earthwork computation, I notice that Allen's tables are omitted. These tables are, I think, better in some respects than any of those mentioned, except, perhaps, Crandall's, to which they are quite similar.

In this connection a discussion of earthwork diagrams would have been interesting, such diagrams are more comprehensive than any table, giving directly, without any computation, the average end area value for the cubic yards represented by any three-level section, and the prismoidal correction can be taken also from a diagram similarly prepared. It is but a few hours' work to figure and draw such a diagram for any given cross-section, and if plotted on 16 × 20-in. cross-section paper, can be read with ample precision, the usual scales being 1 ft. to 1-in. for lengths, and 20 cu. yds. to 1 in. for quantities.

It is surprising that such diagrams are not more widely used.

Yours very truly,

Robt. L. Lund.

Department of Engineering, Vanderbilt University,

Nashville, Tenn., Jan. 21, 1903.

(We inadvertently failed to mention Allen's tables. They are now being revised and will not be in print for at least six weeks yet. When the new edition appears it will be carefully reviewed in these columns.—Ed.)

The Miner's Inch in the Revised Trautwine's Pocket-Book.

Sir: In your article, entitled "The Revised Trautwine," in your Literature Supplement of Jan. 15, you mention certain matters to which our limits of time prevented us from doing justice in the edition recently issued; but in regard to the new matter there is one reference which scarcely seems to be borne out by the facts. You say, "There is a new page on the miner's inch that gives no hint of the fact that there is more than one kind of a miner's inch in use."

The page in question says:

The miner's inch is a unit of rate of discharge of water, largely used in the far Western mining states. It is expressed in terms of a standard orifice, usually 1 in. square and vertical, and a standard head. The head varies from about 3 to 9 ins., but 6 ins. is a commonly accepted standard. . . . . Usually, the orifice is of fixed depth and adjustable length. . . . The thickness of plank, in which the orifice is cut, varies from 1 to 3 ins., and the lower edge of the orifice is often chamfered, flaring outwardly. The bottom of the orifice is sometimes flush with the bottom of the box, but is usually raised 2 or 3 ins. above it, as in our Fig.

A short table is given, showing the discharges, per square inch of opening, under 6-in. head, through openings 2 and 4 ins. high., and 4, 6, 8, 12, 24 and 100 ins. long, and a diagram of discharges through an orifice 1-in. square, under heads ranging from 3 to 9 ins. This, it seemed to us, sufficiently indicated the fact that different miner's inches are used. Yours truly,

John C. Trautwine, Jr.

257 South 4th St., Philadelphia, Pa., Feb. 6, 1903.

(While exception may be justly taken to the wording of our sentence criticising the treatment of the miner's inch in Trautwine's revised handbook, we are nevertheless not convinced that the subject was adequately treated. If there was a "hint" that the miner's inches vary, as appears, the effect of the "hint" seems to have been negatived by the failure to give more than one definite miner's inch in the text. The one given is equivalent to a delivery of 1.466 cu. ft. per min. So far as we know this particular miner's inch is the legal or statute inch in no state or territory.

In our issue of Dec. 6, 1890, will be found an abstract from Vol. 2 of Professor Eggleston's "Metallurgy of Gold and Silver," giving some of the many miner's inches that are or have been in actual use.

The following list gives the discharge in cubic feet per minute corresponding to some of the miner's inches given by Professor Eggleston:

Smartsville, 1.76; North Bloomfield, 1.57; Eureka, 1.39; South Yuba Canal, 1.44; La Grange, 1.50; Arizona, 1.50; California, 1.20; Montana, 1.34; North Carolina, 1.34.

From later sources we find the "legal miner's inch" is as follows:

California, 1.20; Colorado, 1.58; Montana, 1.50; British Columbia, 1.68.

A miner's inch is often defined, not as so many cubic feet of water per minute, but as the amount delivered through a given orifice, under a given head, and lawsuits have arisen over the time of delivery, when the word "day" was used without definition. In some places a 10-hr. day, in others a 11-hr., a 12-hr., or a 24-hr. day is intended.

In some miner's inches the "head" is measured from the center of the orifice; in others from the upper edge of the orifice to the waters surface; but the pocket-book does not indicate which of these two heads was assumed. Many an engineer, we are confident, would be glad to have at hand a brief definition of the statutory miner's inch in each of the States where it exists; and a civil engineer's pocket-book is the place where they might naturally expect to find such information, or else no reference to the subject whatever.—Ed.)

Books on Water Supply, Irrigation, Pipe-Laying and Concrete Dams.

Sir: Could you kindly give me the titles of any good up-to-date books on irrigation and water supply?

A. Struben, Assoc. M. Inst. C. E.

Pretoria, Transvaal, Dec. 22, 1902.

(The best recent treatise on water-works design and construction are Turneaure and Russell's "Public Water Supplies" (New York, 1901; $5), and Folwell's "Water Supply Engineering" (New York, 1900; $4). The former is the more comprehensive of the two, and has valuable bibliographies at the end of the leading chapters. Folwell's book was designed by its author to cover water supply for irrigation, as well as for cities, but it meets only a part of the wants of the irrigation engineer. Of American books on irrigation now available Wilson's "Manual of Irrigation Engineering" (New York, 2d ed., 1897; $4), is the most satisfactory for the engineer, and King's "Irrigation and Drainage" (New York, 1899; $1.50), the best for the scientific farmer. For a somewhat popular book on both the engineering and cultural phases of irrigation Newell's "Irrigation in the United States" (New York, 1902; $2 net), is both recent and good. The economic and legal aspects of irrigation in this country, with some engineering questions, are treated in Mead's "Irrigation Institutions," (New York, 1903; $1.25 net). In addition to the general treatises on water-works there are numerous books on such special phases of the subject as water purification, steel tanks and stand-pipes, pumping machinery, and dams and reservoirs. Finally, a large amount of valuable information may be found in the "Water Supply and Irrigation Papers of the U. S. Geological Survey" (Washington, 1896), which now include over 70 small paper-bound volumes of 100 pages or less. For these, application should be made to the Director of the Survey.—Ed.)

Sir: Can you give me the title and price of any book dealing with the subject of the laying of water mains. I wish to find out the maximum curves and grades that exist in good practice.

Can you also refer to some work on concrete dams; particularly on dams composed entirely of concrete, so that the entire crest acts as the spillway.

Yours very truly, H. T. Ford.

Easton, Pa., Feb. 4, 1903.

(The two water-works treatises mentioned just above contain information on the design of pipe lines and of distribution systems. A more detailed treatment of laying out and constructing water-works distribution systems is Billings's "Some Details of Water-Works Construction" (New York, 1893; $2). There is no book on concrete dams. The standard works on dams in general are Wegmann's "Design and Construction of Dams" (New York, 4th ed., 1899; $5), and Schuylers' "Reservoirs" (New York, 1902; $5). There are also chapters on dams in the water-works treatises already mentioned.—Ed.)

Information Relating to the Price Current Meter.

Sir: We are going to determine the volume of water that flows through the Ohio River, by means of a Price current meter. If you will kindly refer me to any article bearing on the subject, I will be very much obliged.

Very respectfully, C. J. Rannells,
Inspector, Structural Iron and Steel.

U. S. Engineer Office,
Parkersburg, W. Va., Feb. 5, 1903.

(Probably the latest available information on the Price current meter is given in "Accuracy of Stream Measurements," by Prof. Edward Charles Murphy, which appeared as Water Supply and Irrigation Paper No. 64 of the U. S. Geological Survey. The bulletin also contains information on other current meters and on other phases of the general subject indicated by the title. The original Price current meter, with an account of its use in U. S. Engineer Gagings of the Niagara River, was described in Engineering News of March 2, 1893, and in the issue for March 30, following, a letter discussing those gagings was published. A further description of the Price meter, written by the inventor, was published in Engineering News for Jan. 10, 1895. The meter as described in the last-named article, had a pneumatic, instead of an electric indicator, as employed originally. In general, electric indicators are employed on current meters to-day.

Engineering News of Feb. 5, 1903, contained an article on rating current meters, as practiced by the Irrigation Investigation Department of the U. S. Department of Agriculture.—Ed.)

Books Against Municipal Ownership.

Sir: I would like to know what books or pamphlets give the reasons against municipal ownership of water-works, electric lighting plants, gas works, etc. I am interested in these questions, and in arguments against any kind of state or municipal ownership.

Yours truly, R. A. Mitchell.

Alabama City., Ala., Feb. 4, 1903.

(Municipal Public Service Industries," by Allen Ripley Foote (Chicago, 1899; $1), favors private ownership under public control, and contains statements on various phases of municipal ownership by a number of writers and speakers. "Municipalities vs. Private Corporations"; Political and Business Management Compared," by M. J. Francisco (Rutland, Vt., 1900; $1), contains a vast array of figures and statements selected as evidence against municipal ownership. "Municipal Monopolies" (New York, 1899; $2), contains a number of articles on water-works, electric lights, the telephone, street railways, and gas works, by various writers, some of whom tried to present both sides of the municipal ownership question. The arguments are mostly in favor of municipal ownership. "Water, Gas, and Electric Light Plants Under Private and Municipal Ownership," comprising the annual report of the U. S. Commissioner of Labor for 1899, presents, mostly in statistical form, the results of an elaborate and extensive inquiry made in 1898-9 under the direction of Commissioner Wright. Statistics are given for 375 private and 659 public water-works; 356 private and 11 public gas works; 632 private and 320 public electric light plants. The location of the various works is not given, and they are tabulated in the order of gross water consumption, of gas output, and of engine horse-power of electric plants. There are averages of the cost of production, wages, salaries and other statistics, under both forms of ownership, and by groups of plants, but there are no grand averages. The effort at strict impartiality is carried so far, as almost to lessen the value of the work. The "Report of the Special Committee Appointed to Investigate the Relations Between Cities and Towns and Street Railway Companies" (Mass. House Document No. 475, 1898), reviews the street railway experience of European cities and contains a paper by Robert P. Porter on "Municipal Ownership and Operation of Street Railways in England." This paper, like Mr. Porter's increasingly numerous writings on the subject, is against municipal ownership. A British Parliamentary report on "Municipal Trading" (London, 1900; $1.75), contains a mass of testimony on municipal ownership, some of which is most strongly in opposition to the movement. For the relative status of municipal and private ownership of water-works in the United States see "The Manual of American Water-Works," M. N. Baker, Editor (New York, 1897; $3), and for a similar but recent showing for water-works, gas and electric lighting plants, street railways, telephones, central heating stations, ferries, docks and wharves, in places of 3,000 population and upwards, see "The Municipal Year Book," M. N. Baker, Editor (New York, 1902; $3). Pretty full accounts of municipally-owned water-works, lighting plants, street railways and telephones, with a few statistics for private ownership, are given in the British "Municipal Year Book," Robert Donald, Editor (London, 1902; $1.40). Municipal ownership in Great Britain, particularly of lighting plants and street railways, is far in advance of what it is in the United States, and the opposition thereto has brought out the Parliamentary inquiry on municipal trading already mentioned. Finally, "A Bibliography of Municipal Problems and City Conditions," by Robert C. Brooks (New York, 1901; $1.50), contains scores of references to articles, addresses, and discussions of municipal ownership.—Ed.)

Books on Geodetic Astronomy.

Sir: Please advise as to what are the best books on practical astronomy (astronomic and geodetic work) for one who is studying without a teacher; also give the price of the same. Yours truly,

Jose F. Mack.

Liverpool, N. S., Feb. 5, 1903.

(We take the above query to refer to books on the astronomical determinations of geodesy. The following names one or two such works. For a treatment of general astronomy such books as

Young's "General Astronomy" should be consulted.

Prof. Mansfield Merriman in his book, "Precise Surveying and Geodesy" (New York, 1899; $2.50), gives a chapter on "Astronomical Work." This chapter, covering 30 pages, outlines some of the methods for making the astronomical observations of the surveyor, i. e., the observations connected with latitude, azimuth and time determinations; a few pages on longitude determinations are given.

In connection with this chapter some of the other matter in the book may be read: A few remarks on refraction, on p. 101, may help to call attention to this important astronomical correction, though here terrestrial measurements only are considered; Chap. VI., on "Spherical Geodesy," which treats of the spherical form of the earth as affecting angular measurements, and Chap. VII., on "Spheroidal Geodesy," will be suggestive of some of the semi-astronomical features of geodesy. However, all that treats of engineering astronomy in this work is included in Chap. V.

A thorough treatment of the subject will be found in J. F. Hayford's "Text-book of Geodetic Astronomy" (New York, 1898; $3). This is closely representative of practice on the U. S. Coast and Geodetic Survey. The chapter on "Longitude Determinations" is especially valuable, as this matter is treated in only few books on engineering astronomy. Two faults may be charged against Hayford: the explanations are usually not sufficiently concise and clear for the beginner or for one who is studying without a teacher; this fault is due to the inclusion and mention of many minor matters that may be omitted in any but the most precise determinations, and to the introduction of intricate methods of calculation in some cases, as the adjustment of observations by least squares. The second fault is that the methods of observation are not arranged according to their relative precision; in fact, the simple and rapid approximate methods are hardly represented.

These faults are commendably absent in Prof. G. C. Comstock's "Field Astronomy for Engineers" (New York, 1902; $2.50), which is reviewed more in detail on another page of this issue. Here everything that is not strictly necessary for the purposes of the book is rigidly excluded. The explanation of all relations is made extremely simple and concise. The matter is arranged so that the engineer is able to choose at once that method which is best suited for his purpose, and the methods of computations are selected with this same end in view. What is gained by the adoption of rigid simplicity of treatment is especially apparent from a comparison of the first three chapters in this work with the first chapter in Hayford, in which the preliminary general ideas are presented in both cases. It should be remembered, of course, that longitude determinations, and also such refinements as the use of the chronograph or the employment of least square adjustment, are not referred to in Comstock. But for the purposes of the engineer this may be considered rather an advantage than otherwise. On the whole the book of Professor Comstock should closely satisfy the wants of our correspondent.—Ed.)

Sketch Books of Mechanical Movements.

Sir: Would you kindly notice in your Engineering Literature Supplement, "The Engineer's Sketch Book," by Thomas W. Barber, M.E., and any similar works? I particularly want to know if the engravings are of size and clearness to be of value in the drafting room.

Yours, etc., Geo. H. Tinker.

Trinidad, Colo., Feb. 2, 1903.

(As its title implies, "The Engineer's Sketch Book" (London and New York, 4th ed., 1902; $4), contains sketches of mechanical movements and mechanical devices. The book contains 335 pages, a page of text facing a page of sketches. Since about 2,603 different devices are figured, it is evident that each sketch must necessarily be small, there being on an average 16 figures within the border lines (4¼ × 7 ins.) of each page. The aim of the book is to furnish hints for the inventor or the mechanic working out a new machine.

Somewhat similar in scope is a book by Gardner D. Hiscox, M. E., entitled "Mechanical Movements" (New York, 1899; $3). This book contains 402 pages and 1,649 figures, there being about four figures, in the text, to each page, and the text measuring 4 × 6½ ins. The engravings are a trifle larger and better executed than in the "Engineer's Sketch Book," but not so numerous, as will be observed.—Ed.)

Books on Concrete-Steel Arch Design and Calculation.

Sir: I would be glad to know of a book that gives a clear discussion of the ways to calculate for practical design the stresses in arches of concrete and of concrete-steel. Sincerely, Robert Lacy.

Burke's Station, Va., Feb. 14, 1903.

(The best general treatise on concrete-steel construction with which we are familiar is Christophe's "Beton Armé." There is no similar book in English, but a number of books in English are available which contain more or less comprehensive analyses of beams and arches in concrete-steel. Burr's "Elasticity and Resistance of Materials" contains a somewhat detailed analysis of both beams and arches, and there is a short section analyzing beams of concrete and iron in combination in Johnson's "The Materials of Construction." Cain's "Theory of Steel-Concrete Arches" (50 cts.) is a short but very good presentation of the theory of the elastic arch as applied to concrete-steel construction.—Ed.)

A French Engineer's Handbook.

(In answer to an inquiry for a handbook in French, similar to Trautwine, we would state that "Notes et Formules de l'Ingenieur" (Paris, 11th ed., 1897; paper, $2.50 net), is a comprehensive handbook of 1,312 pages (5 × 7 ins.), including about 1,000 illustrations and a French-English-German vocabulary.—Ed.)

The Flow of Water in Pipes and River Channels.

Reviewed by Mansfield Merriman.*

CALCULATIONS IN HYDRAULIC ENGINEERING.—**A Practical Text-Book for the Use of Students, Draftsmen and Engineers. Part II, Calculations in Hydro-Kinetics. By T. Claxton Fidler, M. Inst. C. E., Professor of Civil Engineering, University College, Dundee, University of St. Andrews. London and New York: Longmans, Green & Co. Cloth; 6 × 9½ ins.; pp. 203; 50 illustrations in the text. $3.**

This volume has one chapter on inlets and outlets, while the other eight chapters are devoted to the steady flow of water in pipes, conduits, and river channels. It is mainly a practical book in which mathematical discussions are avoided, and the surprising statement is made that "hydraulic engineers have found but little help from rational theory." The principal aim of the author appears to be to establish exponential empirical formulas for the mean velocity in pipes and channels. The assumed form is

$$S R^m = C V^n,$$

in which S is the slope of the hydraulic gradient, R the hydraulic radius of the cross-section, and V the mean velocity, while the exponents m and n and the constant C depend upon various circumstances and are to be determined by the discussion of experiments. The use of this formula is justified by the fact that it was employed by Hagen and by Lampe, and by the statement that Reynolds considers it to possess "a better claim than any other to a rational foundation in theoretical hydrodynamics."

The author remarks in his preface that this formula will generally require the use of a table of logarithms, and the greater part of two chapters are devoted to explaining how this is done. When values of S, R and V have been determined by gagings of the flow through a pipe, logarithms are necessary to find the values of C, m, and n. After these values are known for different kinds of surfaces, practical computations for finding V, when S and R are given, also require logarithms. The explanations regarding these computations are full and correct, but it is sad reflection on the state of engineering education in Great Britain that such detailed instructions are thought by the author to be necessary. It will also be a surprise to those who know that hydraulic data and results are usually liable to error in the third significant figure, to learn that the author uses six-place logarithms in all his computations.

After having given the values of the exponents for numerous classes of pipes and conduits, and explained how to use the formulas in a few practical cases, the author presents useful tables for smooth pipes and brick conduits, from which results may be conveniently taken without computation. Then he gives coefficients for the Chezy formula, deduced by himself for different kinds of channels. These coefficients are tabulated for different diameters and slopes, an arrangement which possesses some advantages over the usual method of tabulating them with respect to diameters and velocities. Cast-iron and riveted wrought-iron pipes are classed together as having the same coefficients, although it has long been known in this country that those for riveted pipes are the smaller. The author seems to be unaware that numerous experiments have been made in recent years on riveted pipes, for the only ones cited are those made by Hamilton Smith prior to 1885. Kutter's formula he evidently regards as of little value, for it is given only in the metric system of measures. Bazin's formula of 1865 is mentioned, while the more valuable one of 1897 is unnoticed. The Venturi water meter is described, and for its explanation the most extended mathematical discussion in the book is given, most of this being credited to Weisbach.

The author cites 332 gagings of pipes, conduits, and streams for which he has determined the constants of the exponential formula. Of these, 217 were made in France, mostly by D'Arcy, and Bazin, 63 in the United States, 39 in Germany and Switzerland, 10 in India, 2 in Russia, and 1 in England. It is a source of regret that there is little in this volume which is likely to stimulate further experimental work by the engineers of Great Britain. In order that such work may be done with success, the observer must have a good knowledge of the theory of the subject, for such knowledge not only points out how measurements should be made, but it also furnishes the incentive for observing in order that the theory itself may be perfected. The author has done painstaking work in deducing the constants for the exponential formula, but it does not appear that these formulas are likely to replace those in general use until it can be demonstrated that they have a better theoretic basis. This has not been shown in the book, nor is it probable that it can be shown. There is a case on record where Lampe's exponential formula led to a serious error in the size of a large metal conduit, and any empirical hydraulic formula is liable to lead to error unless its use be accompanied by a sound knowledge of the theoretical principles of the subject.

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SPECIFICATIONS FOR ELECTRIC RAILWAY BRIDGES.—**By C. S. Davis. Toledo, O.: The Author. Paper; 6×9 ins.; pp. 48; illustrated. 50 cts.**

These are general specifications intended to serve for electric railway bridges of all capacities likely to be demanded by modern electric railway practice. In arranging his subject matter the author has placed those clauses relating to different subjects, such as design, shop work and field work, in separate divisions to enable easy consultation. The author employs equivalent uniform loads, and all calculations and requirements of the specifications are based on loading of this character.

PUBLIC WORKS DEPARTMENT, SOUTH AUSTRALIA.—**Report for 1901-2. Alex. B. Moncrieff, M. Inst. C. E., M. Am. Soc. C. E., Engineer-in-Chief. Paper: 9 × 13 ins.; pp. 72; tables, plates, and folding maps. Adelaide: Pub. Doc.**

This report opens with a general review of the operations of the department, by Mr. R. W. Foster, Commissioner of Public Works, and continues with a resume by Mr. Moncrieff of the operations of the year on water-works, sewers, water conservation and irrigation, harbor, jetties and lighthouses, roads, and drainage. The bulk of the volume is statistical, covering both the physical and financial operations of the various divisions. There are a few handsome engravings, from photographs by A. Vaughan, including views of the Bundaleer earth dam, completed, and the Barrossa curved concrete dam, under construction.

A New Treatise on Roads and Pavements and Its Relation to Other Books on Those Subjects.

A TREATISE ON ROADS AND PAVEMENTS.—By Ira O. Baker, C. E., Professor of Civil Engineering, University of Illinois. New York: John Wiley & Sons. Cloth; 6 × 9 ins.; pp. 655; 65 tables and 171 illustrations. $5.

With this new addition to the literature of roads and pavements we now have three American works that may be termed manuals, besides five or six smaller books treating more especially of country highways. The manuals are those of Byrne, Tillson, and Baker; the smaller books on roads are those of Gillespie, Gillmore, Herschel and North, Rockwell, Shaler and Gillette; each book in each class being named in the order of its publication. Then in a class by themselves are the two small works of Spalding and Judson which relate more particularly to the general features of city pavements.

It is evident that there is no lack of books in the English language on highway construction, even if we exclude those by such English authors as: Aitkin, Callanan, Codrington, Law and Clark, Maxwell, Mitchell, and Parnell.

Of these English works that of Thomas Aitkin is not only the latest (1900), but is also more comparable in size and scope with the manuals of Byrne, Tillson, and Baker, although it far excels any of these three in the matter of original cost data.

Perhaps there is no better way of showing the merits and limitations of Professor Baker's manual than by comparing it with the American and English works of similar scope.

We find in Baker's work practically all that Byrne's contains, except that Baker has omitted the discussion of culverts, retaining wall design and the like. Byrne had inserted these, following in this respect the precedent established by earlier writers. This omission is perfectly justifiable, since a manual of roads and pavements is sufficiently large without introducing matter that is really extraneous.

Baker has also very little on concrete, and pavement materials generally, being in this respect far less satisfactory than Tillson. Of course, in justification of this scant treatment of these subjects it may be urged that they are already covered in the author's work on "Masonry." Nevertheless, we believe that any work on roads and pavements that purports to be a manual should contain far more data as to the materials than is to be found in Baker's work.

Baker's "Masonry" contains 110 pages on concrete, Baker's "Roads and Pavements" contains 15 pages on the same subject. Considering that nowadays almost every pavement except macadam or tar macadam has a concrete foundation, concrete should have been treated in a more exhaustive manner than is possible in these 15 pages. Tillson's work is much more satisfactory in this respect, containing 40 pages; while Byrne has about the same number of pages on concrete also.

Baker's first chapter is not an historical review of roadwork—indeed, little or no historical data are to be found in the work anywhere. Road economics from the viewpoint of the political economist is the first subject of discussion, and the well-known views of the author are laid down. It is held that the data of the U. S. Department of Agriculture in favor of "good roads" are very misleading; and the labor tax system, if not wholly indorsed, is at any rate not condemned.

By far the most valuable part of this first chapter, and in fact the most original part of the book, is the author's contribution to the knowledge of tractive resistances on various pavements. The author gives data based on his own experiments (see Eng. News, March 6, 1902), and he has also compiled in tabular form most of the previously published data of others. These compilations, together with the original matter, form a more satisfactory treatment of traction than exists in any other manual.

The second chapter (pp. 24) on "Road Location," contains little that is new either in fact or theory, and it is largely given over to the detailed solution of haulage problems. The author correctly observes that "the value of saving distance is very different for wagon roads than for railroads," but many engineers will not agree with him as to the per ton mile cost of hauling assumed.

The chapter on "Earth Roads," covering 75 pages, is twice as long as Byrne's treatment of the subject and much more satisfactory. The cost of earthwork is briefly treated; and it is pleasing to note that it is not dismissed with a half a dozen words, as in Byrne, nor are Trautwine's erroneous tables copied. There is practically nothing new given on earthwork costs, and some that is given is misleading; thus, it is stated that "loose earth" may be hauled 25 ft. with "drag scoop-scrapers" for 9.83 cts. per cu. yd., and with a 200-ft. haul at a cost of 14.03 cts. per cu. yd., which is equivalent to 2.4 cts. per cu. yd. for hauling per 100 ft. of haul. The actual cost is nearly double this, or 5 cts. for hauling a cu. yd. 100 ft. Again the author cites the catalogued output of elevating graders, although by reference to Hill's "Chicago Main Drainage Canal," it will be found that the actual output was less than half the manufacturer's "guaranteed" output. Speaking of the cost of trimming the earth surface on roadwork, the author says "it may amount to ¼ or ½ ct. per cu. yd." As a matter of fact the cost of "trimming" or "sandpapering" should be estimated by the sq. yd., and when distributed over say 3,500 cu. yds. per mile of road excavation, this item becomes several cents per cubic yard, instead of being a small fraction of a cent. There are several other errors of commission and of omission, but the author gives some data of grading prairie roads with a road machine that are valuable if correct, but which appear somewhat too low. And in this connection it may be stated that the author's treatment of costs throughout the book, except where compiled from reliable sources, is far less satisfactory than is to be found in Aitkin's manual, although it is much better than Byrne's wholly inadequate treatment of pavement economics. Tillson's work is unsatisfactory in this respect also, the actual cost of earthwork not being mentioned at all.

Coming to the chapter on broken stone roads (pp. 85) we find a far better treatment of the subject than in Byrne's manual. There is no part of Byrne's book, however, that is so untrustworthy as his chapter on macadam (pp. 34). Byrne's discussion of the subject is not only too short for a manual, but is antiquated and in many respects erroneous. Tillson has a better chapter on the subject, but by no means so satisfactory as has Baker, who has taken very much from the recent work of Gillette and others. He could, with decided advantage, have gathered still more material from the excellent manual of Aitkin; for despite the fact that the latter is an English work, the author has so carefully given the rates of wages, the quantities of materials and other factors, that most of the data are applicable to American conditions. In this respect Aitkin is the only English author on road construction whose data of economics are of much value to Americans.

The chapter on brick pavements (pp. 65) is more satisfactory than that in any book we have seen. In fact it is one of the best chapters in the book. There is very little in it that has not appeared in print before, it is true, but the compilation has been made with good judgment.

The chapter on asphalt (pp. 76), however, is not much if any better than Tillson's, although it excells Byrne's discussion, most of which is embodied in this chapter of Baker's. Chapters on race tracks, both for horses and bicycles, contain matter not to be found in other road books, and the same may be said of bicycle paths.

Stone block pavements are very briefly treated (pp. 28), as are wood block pavements (pp. 13). Although these two types of pavements are in less repute than in the past, they are both used to a large extent, and it is by no means certain that they are doomed to immediate extinction. For this reason they merit far more space than they have received. Tillson's treatment of these two types of pavement is more full and more satisfactory.

The chapter on sidewalks (pp. 33) is much better than Byrne's, while Tillson omits sidewalks entirely; but of curbs and gutters Baker gives a rather inadequate discussion, only nine pages. As far as street design is concerned we find nothing new, although the compilation is good.

Having considered the whole treatise somewhat in detail we may say that as a text-book for students this new work is far superior to Byrne, but partly because it is more recent. It is also superior to Tillson, but chiefly because more comprehensive. Tillson wrote with a much wider experience than has any other author of a manual on pavements, but he held himself closely to that subject, even to the exclusion of sidewalks. This limitation was commendatory, but must be borne in mind in assigning Tillson a place among other treatises on road and street work. But when we look at Baker's work from the viewpoint of the engineer already possessed of most of the American works above mentioned, we find very little that is not to be found in them and in recent current literature. The author has compiled with excellent judgment, but excepting some original data on traction, voids in sand and stone, and analyses of certain gravels, we find no real contribution to the stock of engineering knowledge of roads and pavements.

Compared with Aitkin's admirable work, in so far as new matter is concerned, Baker's is decidedly lacking; although as a text-book Baker's is nevertheless quite as decidedly superior.

In this connection, speaking of English books, we would call attention to that of Maxwell (1899). The author of this little book has scrupulously cited references in the foot-notes of almost every page; and it has mattered not whether he was quoting statistics, principles of construction or theories—all have been given in the words of their original author. Standing out in contrast are many of our American engineering books, among which Baker's is no exception; for, aside from a very few references, and these for the most part references to data only, we find page after page as barren of quotation marks as if the author had been the first ever to write on the subject. Nor is this all; there are not a few passages in Baker's work that with scarcely any change have been transcribed from other books without a word of credit. We concede that engineering literature once published seems more and more to be regarded as common property, but is that just either to the man who has written or to the reader of the compilation? To illustrate we have selected a passage from Baker's work, not because of its importance, but merely as an example. On page 47 of Baker, and on page 27 of Gillespie, will be found these paragraphs:

"ROADS AND PAVEMENTS," By I. O. Baker, 1903. Page 47.	"MANUAL OF ROAD-MAKING." By W. M. Gillespie, 1871. Page 27.
The curving road around a hill may often be no longer than the straight one over it; for the latter is straight only with reference to the horizontal plane, but curved as to the vertical plane, while the former is curved as to the horizontal plane, but straight as to the vertical plane. Both lines curve, and the one passing over the hill is called straight only because its vertical curvature is less apparent to the eye.	Precisely so may the curving road around a hill be often no longer than the straight one over it; for the latter road is straight only with reference to the vertical plane which passes through it, and is curved with reference to a horizontal plane; while the former level road, though curved as to the vertical plane is straight as to a horizontal one. Both lines thus curve, and we call the latter one straight in preference, only because its vertical curvature is less apparent to our eyes.

We should have made no mention of this parallelism were it an isolated example of failure to quote or give reference. It is neither the only example nor the most important one.

Doubtless the author is innocent of any intent to be unfair; for, as we have said, it is the prevailing fashion to appropriate what seems the best in engineering literature, making little or no mention of the source. Following this process to its logical conclusion, a copyright becomes valueless, and what is of more importance, the author of a meritorious book of small dimensions soon sees his work disappearing like Jonah into the whale.

There are other reasons why principles of construction and the like should be duly accredited to their originators; for a compiler is very apt to give only the generalizations without the reasons and individual examples cited by the earlier writer. This failure to cite authorities has been the means of passing on many an erroneous or incomplete generalization from one generation of writers to the next; like Macadam's old rule prohibiting the use of any stone larger than a hen's egg.

A copious citation of authorities, moreover, increases the reader's respect for an author rather than the reverse. At the same time, it enables the reader to judge the age of any given rule or practice, and in that way often leads him to seek improvements in the practice. Furthermore, a citation of authorities emphasizes the fact that even authorities disagree, and one concrete example of such disagreement impresses the student for more than any general statement to that effect. In this connection we may say that Baker's manual contains no bibliography—a small but none the less important omission.

There is still another advantage that comes from direct reference to individual examples of construction methods and details. Such examples are usually accompanied by many details, which, to the compiler, may seem unimportant. The writer of a modern text-book generally seeks to eliminate all such details, and in their place gives generalizations of his own, which may in fact be mere platitudes. Instead of laying down long rules as to what should be done, is it not better to describe what is done in several specified cases, following with criticisms, if desired?

Finally, as we lay aside this manual of roads and pavements, this question suggests itself: Is any writer justified in trying to cover so wide a field in one volume? To do so necessarily means in most cases that the author must write a great deal about many things of which by personal experience he knows very little. In a word, he must appropriate the work of other writers, each of whom in his own field is probably a better authority. Being so, is it not a far better practice to write separate monographs rather than exhaustive treatises that are, in fact, a collection of monographs?

The advantages of such a practice would be many. To begin with, natural selection would more readily operate in securing the survival of the fittest. In the second place, advances in the art or science of allied structures or products are not uniform, so that while brick paving, for example, may remain practically unimproved for a decade or more, on the contrary, macadam paving may make sudden and great advances, or vice versa. The point of this is that while a rewriting of a huge manual is a task not to be undertaken except at great expense, a single small monograph may be quickly and cheaply revised or entirely rewritten. Third, there are an ever increasing number of purchasers asking for books containing information on some one particular subject. Thus a purchaser wishes a monograph on wood pavements. As things now are, he must either pay a high price for a manual containing much besides that which he wants, or he must go without a book, which he often does, because he feels that he cannot afford to spend $5, say, for a large book. In a word, if instead of a manual on roads and pavements, we had five monographs on the various types of pavements, each of which could be purchased for $1, might not the wants of both students and engineers be more fully met?

The tendency toward specialization in engineering literature has been very marked in the recent past, and it will become more so in the future. Few know enough to write well on everything, but those who could write well on something are now deterred, in many cases, because they do not like to see their work go for naught, as it does and will continue to do so long as technical literature is looked upon as common property.

Whether viewed from the point of justice, or of expediency, or of profit, is not the time fast approaching when the monograph will displace the manual, not only in the library of the practicing engineer, but as a text-book in technical colleges?

The Discovery and Explorations of the Colorado River.

THE ROMANCE OF THE COLORADO RIVER.—The Story of its Discovery in 1540, with an Account of the Later Explorations, and with Special Reference to the Voyages of Powell through the Line of the Great Canyons. By Frederick S. Dellenbaugh, Member of the U. S. Colorado River Expedition of 1871 and 1872. New York: G. P. Putnam's Sons. Cloth; 6 × 9 ins.; pp. 399; many illustrations. $3.50 net.

This book records the history of a mighty river for a period of 350 years, from its discovery and partial ascension by the Spaniard Hernardo de Alonçon in 1540 to the Brown-Stanton railway survey of 1889-90. And yet the river is unknown save for the records of a few intrepid explorers, and its banks still are and perhaps will always remain practically uninhabited. This strange contrast with the other great rivers of the world, for "counting the Green as the Upper Colorado" the river is about 2,000 miles long, and drains an area of some 300,000 square miles, is due to the barren country and the deep canyons through which the stream flows.

The explorers of the river fall into three groups: (1) the early Spaniards, seeking fabulous riches; (2) the trappers, and later the gold-seekers, crossing the stream on their way to California; and (3) nineteenth century.

The center of interest in the present volume is the two voyages down the river by the late Major Powell, and of these two the most interesting is the second one, in 1871-2, with the author of this book as a member, and, years after, a narrator of the thrilling incidents of the trip. Mr. Dellenbough has told the story of his own voyage down the river in an animated manner, and he has also given as vivid a picture of the earlier Powell voyage as could be expected from anyone not an eyewitness. The narrative of Alonçon's voyage part way up the river in 1540, is also well told, although as stories this and some of the overland trips of the Spaniards suffer from attempts to clear up uncertainties regarding the localities mentioned in the early accounts. The Brown-Stanton railway survey, also made in connection with a voyage down the river, is hastily sketched.

Anyone who proposes to attempt such dangerous river navigation as that of the Colorado would do well to study the experience with the various small boats used on that stream, and to avoid modelling their craft upon the numerous frail shells dashed to pieces in the rocky rapids of the Colorado. The boats used on the second Powell expedition, and those designed by Mr. Stanton for the Brown-Stanton survey, after one set of frail boats had been destroyed, appear to have been remarkably adapted to their purpose. This was particularly true of the Powell boats, whose water-tight bulkheads placed crosswise increased the strength as well as the safety of the boats, and at the same time afforded protection to the supplies.

Mr. Dellenbaugh's volume is profusely illustrated with half-tone reproductions of photographs, and with a few similar reproductions of his own paintings, besides which there is, for a frontispiece, a reproduction in colors of a water-color sketch by Thomas Moran, N. A., entitled "Looking up the Bright Angel Trail." This trail leads into the Grand Canyon, "which at this point is some 6,000 ft. deep."

An epilogue is very fittingly devoted to an appreciative sketch of the life of Major Powell, who had promised to write an introduction to the volume, but was prevented from doing so by an illness that proved fatal. An appendix gives a list of the canyons, valleys, and mouths of the principal tributaries of the Colorado, from its source on Fremont Peak, Wind River Mts. (13,790 el.) to the Gulf of California, with their lengths, greatest depths, altitudes, and descents, all in feet.

It may be added that the Brown-Stanton expedition was described at length, with illustrations, by Mr. Robert B. Stanton, in Engineering News of Sept. 21, 1889, and Oct. 18. 1899. As was pointed out editorially in each of the issues of Engineering News named, the canyons of the Colorado as portrayed by an explorer, largely in rapid passages by boat, make a different impression than as pictured by an engineer who has made a railway survey through them.

Textile Fibers.

THE TEXTILE FIBERS OF COMMERCE.—By William J. Hannan. London: Chas. Griffin & Co. Philadelphia: J. B. Lippincott Co. Cloth; 6½ × 9 ins.; pp. 236; 149 illustrations. $3 net.

No pains seem to have been spared to secure for this book descriptions of everything which could by the most liberal interpretation be classed either as actual or possible textile fibers of commerce.

Taking up first the vegetable fibers: These are divided into (1) plumose, (2) stem and leaf, and (3) fruit fibers. The plumose fibers are found on the fruits and seeds of plants, and serve to distribute the latter by means of the wind. The most important example in this class is cotton, and other familiar examples, although of little or no commercial value, are afforded by willows and thistles. Of the stem fibers, flax, hemp, jute, and ramie are well known; and of the leaf, manila hemp is perhaps the most important. Of fruit fibers the cocoanut, from which coir is produced, may be mentioned. Cotton is given 46 pages. A list of no less than 50 fibers which have been used in paper-making is given, but most of these are of little account as compared with wood pulp. This material, and its preparation, is described at some length.

Animal fibers are taken up in detail, particularly wool and silk, the hat and felting fibers, and materials used for brushes and mats. The badger, bear, hog, sable, and squirrel are given as the principal sources of the bristles so extensively used for brushes, but besides bristles, 16 vegetable fibers used for brushes are described.

The compilation as a whole contains a vast amount of valuable material, some of which is badly classified, although appearing to be correct in itself. A large amount of irrelevant, although generally interesting, material is included, but the temptation to do this is great when an author has secured, at great trouble, and perhaps no little expense, information which, though aside from his main purpose, is not readily available elsewhere.

The illustrations are well chosen, are kept subordinate to the text, yet supplement it most admirably, and they are well reproduced.

An English Book on Surveying.

SURVEYING AS PRACTICED BY CIVIL ENGINEERS AND SURVEYORS.—Including the setting-out of works for construction and surveys abroad, with examples taken from actual practice. Intended as a hand-book for field and office use, also as a text-book for students. By John Whitelaw, Jr., Assoc. M. Inst. C. E. London: Crosby, Lockwood & Son; New York: D. Van Nostrand Co. Cloth; 5¼ × 8 ins.; pp. 516; 200 illustrations. $4, net.

This work is interesting and curious to the American engineer rather than valuable as a guide in practice. While it is issued as a "hand-book" for field and office use, it is thoroughly English in all its detail, with the 66-ft. chain as a unit of length, the dumpy level, and the 6-in. theodolite with single graduation from zero to 360°. The author discusses in separate chapters chain and instrumental surveying, leveling, railway and road surveys, marine and astronomical surveying, etc. The field outlined is a large and varied one, but Mr. Whitelaw is a little too concise in treating some of these subjects, as when he disposes of "Surveys for water supply works" in five pages. Among the novelties for American engineers are: The preparation of Parliamentary plans and profiles; the very free use of the Ordnance maps in locating the line of a railway, and the methods employed in "pegging out" and cross-sectioning the line. The author quotes freely from Johnson's "Theory and Practice of Surveying," and admits that American methods in railway work have marked advantages over English practice in saving of time and labor. A chapter is devoted to "Surveys Abroad in Undeveloped Country," and under this the author recommends the American method of cross-sectioning, but gives very little of real value to the engineer in the "jungle or dense forest." He tells, however, that astronomical surveying is generally necessary in new countries, and he devotes considerable space to this subject. In a word, the book may be very useful to Englishmen, but it is not likely to be of much service in this country.

An Engineering Study of Sea Coasts.

THE SEA COAST.—(1) Destruction. (2) Littoral Drift. (3) Protection. By W. H. Wheeler, M. Inst. C. E. London and New York: Longmans, Green & Co. Cloth; 6 × 9½ ins.; pp. 361; one plate and 38 illustrations in the text. $4.50.

That the author of this book has been an indefatigable student of his subject is very evident. Indeed, so far as the coasts of his own country (England) are concerned his studies have been almost microscopic. From "Northumberland on the east to Cumberland on the west" he has traversed these coasts and recorded almost step by step the physical characteristics of shore and beach. The result has been an accumulation of gazetteer matter concerning the English coast and works of coast protection which is truly noteworthy. This descriptive matter forms considerably more than half of the book before us. The remainder of the volume is devoted to a statement of the general conclusions and principles of practice which the author deduces from his detailed studies.

In beginning the discussion of his subject the author wisely emphasizes the fact that any consideration whether coast destruction shall be allowed to go on without check or whether remedies should be adopted for protection, ultimately resolves itself into a question of money and convenience. In many cases there can be no doubt of the wisdom and necessity of protective works, but in many other cases the cost of protection may easily be greater than the value of the land protected. Having given this needful caution the author states his main subject as follows:

> Previous to designing works of coast defense, it is necessary to have a clear conception as to:
> (1) The forces in operation causing the destruction of the cliffs and the denudation of material from the shore.
> (2) The way in which these forces operate.
> (3) The source of supply of material composing beaches; the different class of materials; and the quantity available for maintaining them.
> (4) The movement of littoral drift; the agents that cause such movement, and how they operate; and the general direction of the drift.
> (5) The best form of structural works for preventing the drift of material and denudation of beaches.

The action of shore waves is first considered. These are classed as tidal waves, wind waves, ground swells, and breaking waves, and the manner in which the waves of each class act to destroy and denude the shore and beach is described. The power of waves and the force of impact of waves are next discussed. To illustrate the power of waves numerous specific cases of wave action on beaches and marine structures are cited. In endeavoring to convey an idea of the force of impact of waves the author makes use of the following extraordinary reasoning:

> It is not practicable, owing to the fluid character of water, to reduce to a mechanical calculation with any exactness the force of the impact with which breaking waves strike a cliff, or other vertical face, with which they are brought in contact. If the wave be treated as a solid body moving with a certain velocity, its kinetic energy, or power to move material, would be the product of the weight and the height from which it descended. The mean height from which the water of a wave may be taken as descending is half that of the height from the trough to the crest. Taking a wave 10 ft. high, and the depth of water where it breaks, in repose, at 5 ft.; the weight of sea water as 64 lbs. per cubic foot; the length of the wave as 30 ft.; the velocity of movement due to a head of 5 ft. as 18 ft. a second; the weight of the water in movement for 1 ft. in width would be 30 × 1 × 5 × 64 = 9,600 lbs. or 4.27 tons. The kinetic energy would be the product of 4.27 tons falling from a height of 5 ft., or 21.35 tons, or 4.27 tons per foot super. That is to say, each wave would be capable of moving about 21½ tons of material, eroded from the cliffs, to a height of 1 ft. . . . Experiments made by the late Mr. Thomas Stevenson with the marine dynamometer which he constructed for measuring the force of impact of waves in harbor walls and exposed piers, give a very much lower result than shown by the above calculation. With waves 10 ft. high, the mean pressure recorded was 1.36 tons per square foot, or about one-third of that given.

Putting aside all further comment on the above quotation, we may say that even more surprising comparisons than this are likely to be obtained where one measures dynamometer pressure and kinetic energy by the same unit. The figures which are given further on of experiments made at various places on wave impact are interesting and useful. These figures bring the author to the second phase of his subject, which is the source of supply and character of beach materials, their movement and the agents which cause such movement.

Regarding the source of supply of beach material, it is pointed out that other agents than those now existing were necessary for the vast accumulations of beach material which now exist, and the author goes on to substantiate this assertion by numerous evidences and examples, and also to show that all beach material was in the past and is still derived from the land and never, except in insignificant amounts and infrequent instances, from the sea. The three principal beach materials, alluvium, shingle and sand, are next discussed and described. Special beach formations, such as sand spits and sand dunes and the causes of these formations are here described. An interesting section on settlement of solid matter in fresh and salt water follows, in which the author combats the theory that alluvial matter settles more rapidly in salt than in fresh water. The succeeding sections consider the direction of travel of beach material and the agents which cause this movement and the manner in which they operate. This chapter on littoral drift is of exceeding interest.

In the following three chapters the structural works for preventing the drift of material and denudation of beaches are described and discussed. First the various forms of sea walls are taken up under the following headings: Upright walls, sloping walls, most effective form of sea wall, forces operating on a sea wall, effect of walls on the beach, strength of walls, materials for facing walls, timber walls. A number of examples of actual sea wall construction are next described and commented upon. Groynes are then considered, the following topics being taken up in order: Effect of Groynes on Wave Action; Groynes on Sandy Beaches; Distance Apart; Height; Direction; Length; Cost of Groynes; Case System; Beach's System. These three chapters will be to many those of most direct interest to be found in the book. They are followed by the description of the English coast previously referred to and by similar descriptions of the coasts of north France, Belgium, and Holland. These chapters, as before stated, give a very large amount of detailed information regarding the coasts named, but to the general reader they are of much less practical value than the technical discussions which precede them. The book closes with an excellent index.

In conclusion, we desire to commend the publishers for the mechanical make-up of this book. In binding, typography, paper and general form and appearance it is a model of good taste and good workmanship, and one which we should be glad to see other publishers copy.

A New System of Traction for Common Roads.

A NEW SYSTEM OF HEAVY GOODS TRANSPORT ON COMMON ROADS.—By Bramah Joseph Diplock. London and New York: Longmans, Green & Co. Cloth; 6 × 9½ ins.; pp. 116; 27 illustrations. $2 net; by mail, $2.11.

It is somewhat unusual for an inventor to offer for sale in the form of a technical book the particulars of an almost untried invention, and he more generally issues such information in the form of a trade pamphlet for free distribution. The book before us exploits a traction engine with a new type of wheel and a special style of wagon to be used in connection with the engine for conducting traffic on the public roads. All these are covered by patents, but none of the wagons have yet been built. Two experimental engines have been built, and the special features of the design have been highly commended by Professor Hele-Shaw, of University College, Liverpool, who has made somewhat of a study of road locomotion, and by Lieutenant-Colonel Crompton, Royal Engineers, who has had many years of experience with the traction engines and their work in military service in India and elsewhere. Reports made by these gentlemen are embodied in the book. The Diplock engines do not appear to have been employed in regular service, but only in tests and experiments.

The special features of the engine are (1) the gearing, which is mounted on the middle of the axle; (2) the use of the four instead of only two wheels for driving or adhesion purposes; (3) a flexibility by which the axles can radiate in opposite directions horizontally and tilt in opposite directions vertically without disturbing the driving gear or the equilibrium of the engine; and (4) a special form of wheel fitted with feet or blocks which increase the bearing surface and facilitate passage over holes or obstructions, while at the same time reducing the amount of damage to the road. These wheels are the principal feature of the design and are described very fully. The feet or blocks may be compared to the floats of a feathering paddle wheel, being guided by mechanism so that they strike flat upon the ground or upon an obstruction. The blocks are guided into position by rollers running against a curved guide-bar, to which Mr. Diplock gives the coined name of "pedrail," which name he also applies to the engine constructed on this system.

Very little is said about the mechanical construction of the engine, but we find that the first engine, weighed 15½ tons, and hauled a train load of 71½ tons on a soft road. The second and improved engine is a compound, with cylinders 6½ × 10 and 10 × 10 ins., and designed for speeds of four and five miles an hour. This engine has been tested by running over obstructions, but there are no records of its size, weight or capacity, except that Professor Hele-Shaw's report states that if the first engine could haul 87 tons (including its own weight), the second one should be able to haul 150 to 200 tons on the level. The life of ordinary traction engines is given as only four or five years, which Mr. Diplock thinks may be increased to 30 or 40 years.

Those parts of the book which deal with the traffic are disappointing. In the introduction the author states that he has had the superintendence of a large amount of traction engine haulage under exceptional and difficult circumstances. Beyond this statement he does not go, but it is unfortunate that he has not put on record some of this practical experience, as there is so little definite information concerning the handling of traffic of this kind. An elaborate scheme of working regular traffic on a comprehensive system of main and branch routes is described, and is claimed to possess many advantages over any system of light railway.

In his estimates, Mr. Diplock puts the cost of an engine and eight wagons at $25,000; operating expenses for one year (depreciation, repairs, fuel, water, supplies and wages), $8,850; operating expenses per ton-mile (with full load), 0.3 ct. He gives the railway freight rate for distances up to 35 miles as 8 cts. per ton per mile, and proposes a rate of 2 cts. per mile for the road transportation system. All this makes interesting but hardly convincing reading, as everything is apparently based upon assumptions. We get only one side of the question, and that is the theoretical side.

The Business Ideas of Andrew Carnegie.

THE EMPIRE OF BUSINESS.—By Andrew Carnegie. New York: Doubleday, Page & Co. Cloth; 7 × 10 ins.; pp. 345; frontispiece portrait. $3 net.

Mr. Carnegie is himself an eminently successful business man, for he has achieved in a marked degree all that the world holds as the measure of industrial and material success. His views, therefore, upon what he regards as essential in this direction are well worth reading, and especially worth reading by the younger men, to whom he addresses much that he has to say. From his own long business career he points out the road to business success; the essentials in character and conduct, and the conditions that assist the young man in attaining the end in view. While regarding the accumulation of money as the duty of every good American citizen, Mr. Carnegie tells us that the acquirement of vast wealth is "a great responsibility" rather than a virtue, and that surplus wealth permits merely an elaboration of the simple needs of life—though it is just this elaboration that most of us are striving for.

Mr. Carnegie goes on, in separate chapters, to discuss wealth and its proper use, trade relations between England and America, the present and future of the iron and steel industries here and abroad, the cost of living in Great Britain, railways and other topics. As might be expected from his position in the industrial world, the author is not alarmed at the "Bugaboo of Trusts"—as he heads his chapter on this much-discussed subject. He argues that combinations and consolidations of interests are the order of the day, and are themselves the legitimate outcome of previous unbearable conditions resulting from the natural development of business and business ri-

valry. Mr. Carnegie believes that legitimate combinations of this type tend to lower the cost of production, to increase the output, and to lower prices to the consumer. And he adds that the unchanging and irresistible economic laws are always in force against such combinations, and any attempt to circumvent these laws means disaster to the trust, sooner or later. He concludes that these so-called trusts in nowise menace the permanent interests of the nation, because the very conditions that create them are also constantly working for their overthrow the moment that excessive profits or undue privileges attract fresh capital into rival enterprises.

Upon the subject of surplus wealth and its distribution, Mr. Carnegie is a recognized authority; and in his lecture to Cornell students on this head he remarks that it would be "a great mistake for the community to shoot the millionaires, for they are the bees that make the most honey and contribute most to the hive even after they have gorged themselves full." He gives statistics to show that the masses of the people in any country are prosperous and comfortable just in proportion as there are millionaires in that country. The modern millionaire is usually a man of very simple tastes or even miserly habits; he toils himself harder than his clerk; and he is constantly using his capital in enterprises that give thousands employment; his money is always circulating somewhere. Mr. Carnegie tells us that at the end of this rich man's life, millions bequeathed to sons and daughters prove "an almighty curse." Nor does he believe in rich men waiting until the end before giving these millions to public institutions; there is no grace, and can be no blessing, in giving what cannot be withheld. Finally, he says that the only noble use of surplus wealth is for the possessor to administer it himself for the highest good of the people; and he suggests that the epitaph of every rich man should be that upon the monument of Pitt:

> He lived without ostentation,
> And he died poor.

As has been said before—there are many who would be willing to assist Mr. Carnegie in carrying out this latter ambition; though the motives behind this proferred assistance are not exactly in accord with the principles laid down in "The Empire of Business." But the book is well worth reading, for the views it expresses and the advice it gives, and for the shrewd Scotch common-sense that underlies it all.

The Autobiography of George Francis Train.

MY LIFE IN MANY STATES AND FOREIGN LANDS.—Dictated in My Seventy-Fourth Year. By George Francis Train. New York: D. Appleton & Co. Cloth; 5 × 8 ins.; pp. 348; eight illustrations. $1.25 net; by mail $1.37.

This is a unique story of and by a unique man. In it he claims to have done many things to which others might equally well lay claim, but there is no question but that he played an important part in developing American sailing vessels of large burden and high speed, that he introduced street railways in England, that he helped develop some of the early American transcontinental railways, and that he three times established a record for fast trips around the world, the last of which was made in 60 days. This story was dictated by Mr. Train at the age of 73 in the Mills Hotel, New York city, in a total of 35 hours; that fact, as well as the story itself, illustrates forcibly what a man can do if he resolutely sets and holds himself to a well-defined object and method.

As typical of the man, one of his concluding paragraphs, following immediately after his account of his three trips round the world, may be quoted, as follows:

> But I give this brief account of my voyages, at the end of my autobiography, chiefly because I regard them as somewhat typical of my life. I have lived fast. I have ever been an advoate of speed. I was born into a slow world, and I wished to oil the wheels and gear, so that the machine would spin faster and, withal, to better purposes. I suggested larger and fleeter ships, to shorten travel on the ocean. I built street railways, so that the workers of the world might save a few minutes from their days of pitiless toil, and so might have a little leisure for enjoyment and self-improvement. I built great railway lines—the Atlantic and Great Western, and the Union Pacific—that the continent might be traversed by men and commerce more rapidly, and its waste places made to blossom like the rose. I wished to add a stimulus, a spur, a goad—if necessary—that the slow, old world might go on more swiftly, "and fetch the age of gold," with more leisure, more culture, more happiness. And so I put faster ships on the ocean, and faster means of travel on land.

Current American Biography.

WHO'S WHO IN AMERICA.—A Biographical Dictionary of Notable Living Men and Women of the United States. Edited by John W. Leonard. Chicago: A. N. Marquis & Co. Cloth; 6 × 8 ins.; pp. 1391. $2.75.

The first edition of this book was published in 1899, and future editions have been greatly enlarged and improved, until in the present edition there are 11,551 names and biographies. There are also about 20 pages of a necrological list of prominent men and women who have died since 1895. The biographies include the date and place of birth, parentage, occupation, education, scientific attainments, professional work, literary work, public positions held, present address, etc. In the case of authors, particular pains have been taken to secure complete lists of their published works, with the dates of publication, and a system of key symbols has been adopted to indicate the publishers of the works. This system and the giving of the addresses are special features of the book.

While the book comprises mainly the biographies of Americans, it also includes foreign ministers and ambassadors accredited to this country and other foreigners of note who, by frequent visits, or in other ways, have become subjects of inquiry or interest in the United States. Of the 11,551 persons included in this biographical work, 9,760 have furnished information respecting their education, from which it appears that 4,521 are graduates of universities and colleges (or 4,810 if the United States military and naval academies are included), 965 attended such institutions but were not graduated, 889 closed their scholastic career in academies and other institutions of a secondary grade, and 1,164 finished in the public, high and normal schoools. The graduates from technical schools number 327, including engineers, architects, chemists, etc., but it is probable that many others are included among the 4,521 graduates of universities and colleges.

The Treatment and Utilization of Trades Waste in England.

TRADES WASTE: ITS TREATMENT AND UTILIZATION.—With Special Reference to the Prevention of Rivers Pollution. By W. Naylor, Assoc. M. Inst. C. E., Chief Inspector of Rivers, Ribble Joint Committee. London: Chas. Griffin & Co. Philadelphia: J. B. Lippincott Co. Cloth; 7 × 9 ins.; pp. 267; tables, 48 plates, and many illustrations in the text.

This is the first book, at least in English, on the treatment and utilization of manufacturing wastes. Until something much better appears, and this is not likely to be for some years to come, no engineer or works manager having manufacturing wastes' problems to solve can make a mistake in adding this book to his library.

The book is confined almost wholly to the problems and practice of England. The author does refer to the special report of the Massachusetts State Board of Health, made in 1890, but like most British writers he does not get beyond that date. Later Massachusetts reports contain some valuable studies, and the chief investigations of trade wastes made in this country prior to 1893 are reviewed in Rafter and Baker's "Sewage Disposal in the United States." British readers will be the chief sufferers from this neglect of American sources of information, since engineers here would scarcely look to a foreign publication for instruction regarding work done at home. Nevertheless, the value of the book might have been increased by a review of American, and presumably of German practice.

Another feature of the book that will strike American engineers as quite unlike most American treatises on sanitation is the large number of proprietary processes and apparatus included. In this country it is the exception for a sanitary engineer to attempt to control by patents or the formation of promoting companies any contribution which he makes to the advancement of the public health, but in England, it seems to us here, it is rather the exception not to patent improvements, or in some way to hedge them about for private benefit.

After a general review of rivers pollution prevention in England the author devotes a long chapter to "Chemical Engineering." This includes a brief study, with mathematical equations, of the laws of sedimentation; sections on preparing, mixing and applying chemical precipitants; on sludge treatment, and on several types of mechanical filters. There is also an illustrated description of the methods employed in designing settling tank walls, with accounts of the failures of a number of such walls.

Most of the book is taken up with successive chapters on the nature and treatment of wastes from woollen mills, tanneries, breweries and distilleries, calico bleaching, printing and dyeing works, paper-making plants, and various chemical industries. In the course of these chapters the trade processes involved are described as needed to give an intelligent idea of the conditions prevailing, apparatus for recovering by-products and reagents are described, as well as various tanks, evaporators, and filters. Many analyses are also given. Curiously enough, the septic tank, Sutton bacteria beds, the Stoddart filter, and the Whittaker & Bryant filter, are described in the chapter on "Tanning and Fellmongery." These methods might better have been given a chapter by themselves, following the one on "Chemical Engineering," with some such title as "Bacterial Processes." Immediately afterwards it would have been particularly helpful if the author had inserted a chapter showing the general range of application to trade wastes of simple sedimentation, chemical precipitation, mechanical separation (mere straining), and both anaërobic and aërobic treatment.

All the criticisms made are designed merely to show how a very good book might have been made still better, and to that end we wish to add one more: The possibility of eliminating many of the folding plates had the original drawings been made and lettered for a greater reduction. Awkward and entirely unnecessary folding plates are one of the most common faults of all engineering books, American and foreign. They add to the cost of publication and detract from the ready use of engineering works, all to no profit to anyone except the engraver, the paper manufacturer, and the binder.

FRICTION HEAD DIAGRAMS FOR FLOW OF WATER IN CLEAN IRON PIPES.—By Prof. I. P. Church. Paper; 6 × 9 ins.; pp. 4. Ithaca, N. Y.: Address the author.

Of the two diagrams here given one is for cast-iron and for non-riveted wrought iron pipes from ¾ to 8 ins. in diameter; the other is for 10 to 72-in. cast-iron pipes. Two pages of text, illustrated by sketches, accompany the friction head diagrams.

The Science and Art of Disinfection.

DISINFECTION AND DISINFECTANTS.—A Practical Guide for Sanitarians, Health and Quarantine Officers. By M. J. Rosenau, M.D., Director of the Hygienic Laboratory and Passed Assistant Surgeon, U. S. Public Health and Marine-Hospital Service, Washington, D. C. Philadelphia: P. Blakiston's Son & Co. Cloth; 6 × 8 ins.; pp. 353; 97 illustrations. $2 net.

This is one of the most satisfactory technical books ever published, and there is need for just such a volume. The subject is presented from three distinct points of view, and in as many distinct sections: (1) Available disinfectants; (2) objects to be disinfected; (3) diseases in connection with which disinfection is required. As the author says, this plan involves some repetition, but in this case repetition is advantageous. After a brief but satisfactory introduction the author devotes a chapter, each, to physical germicidal agents, like sunlight, burning, and boiling, to gases, and to chemical solutions used as disinfectants. These chapters state the advantages and limitations of each method or agent, the best way of applying it, and, where special apparatus are required, these are illustrated and described. There is a chapter on insecticides and their application, one on "Disinfection of Houses, Ships and Objects," in which there are considered, in alphabetical order, almost every conceivable object ever requiring disinfection, with the best means to employ in each case. This chapter includes air, bandages, beds, books, carpets, hands, houses, milk, money, railroad cars, rooms, ships, stables, water, water pipes, wells, and many other things. The final chapter considers in detail the problems, agents, and methods involved for each of the many communicable diseases. The only other work, at least in English, with which this one can be compared is one bearing the same title, written a few years ago, by Dr. Samuel Rideal, of

London. Without reflecting at all upon that volume, it may be said that Dr. Rosenau's work is far more satisfactory for use to-day, because it is more recent and better fitted for every day use. Still another publication with the same main title was issued in 1888 by the American Public Health Association. It was the result of three years work, from 1884 to 1887, by a Committee on Disinfectants, consisting of seven members, with Dr. Geo. M. Sternberg, Surgeon U. S. A., as Chairman. It included descriptions and results of many experiments, and contained a bibliography for the years 1880 to 1886. The report of the State Board of Health of Maine for the years 1896 and 1897 contains the results of special investigations on formaldehyde, by Prof. F. C. Robinson and B. L. Bryant, of Bowdoin College, and also some extensive "Notes on Disinfectants and Disinfection," by Dr. A. G. Young, Secretary of the Board. Finally, there is a brief presentation of the subject, which is good for the space available, in Chapin's "Municipal Sanitation in the United States," reveiwed in the December issue of this Supplement. Dr. Chapin gives some information as to the State and municipal legislation on the subject, and presents in detail the practice in a few cities. This suggests one phase of disinfection, namely, organization of disinfecting departments, that is not treated by Dr. Rosenau.

Galvanic Batteries.

GALVANIC BATTERIES.—Their Theory, Construction and Use, Comprising Primary, Single and Double Fluid Cells, Secondary and Gas Batteries. By S. R. Bottone. London and New York: Whittaker & Co. Cloth; 5 × 7 ins.; pp. 376; 144 illustrations. $1.50.

Anyone looking for a lengthy list of different cells and modifications thereof, may find it in this book, if he does not object to a heterogeneous arrangement of the matter. The index, at the back, gives the various names of cells and their inventors in alphabetical arrangement, and this enables one to find the particular cell wanted. The entire history of the art of constructing batteries seems to have been harrowed over to find different arrangements of electrodes and liquids which have at one time or another been proposed or used for primary or secondary cells.

What value the book possesses lies entirely in this feature: The listing, in endless detail, of the cells which different men have constructed. There are six pages, the concluding chapter, which under the heading "On the choice of batteries for specific purposes," offer some helpful suggestions to one who wishes to employ a primary battery for any certain purpose. Even in this case he is apt to get as much or more information from the man who sells him the cells. However, if there is little of practical value in the book, as a museum of cell curiosities it may claim to be worthy of a place on the shelves of some libraries.

A Simple Exposition of Applied Electricity.

THE HOW AND WHY OF ELECTRICITY.—A Book of Information for Non-Technical Readers. By Charles Tripler Child. New York: Electrical Review Publishing Co. Cloth; 5 × 8 ins.; pp. 127; 40 illustrations in the text. $1.

This book is the last work of the author, completed shortly before his death last year. It is a short popular exposition of the phenomena of electricity and of its applications. It is smoothly written, in a clear style; the technical expressions used are explained as they result from the exposition of the electrical actions, and the non-electrical reader will be able to read the book easily and without especial study. It may seem remarkable that the author has been able to cover nearly the entire field of electrical applications in the small compass of 127 pages, but we find chapters on the telegraph, on the telephone and the accessory switchboard apparatus, on dynamos and electric railways, alternating current generators, polyphase motors, incandescent and arc lamps, storage batteries, and even on wireless telegraphy and Roentgen rays. Yet all these ways of employing electricity in the service of man are described simply and successfully. For example, in four and one-half pages the method of communicating without wires is made to appear an extremely simple thing (which it really is) and the theory of the electrical action taking place is fully presented in a paragraph of a dozen lines. Of course this particular application of electricity is not as useful to the world at large as others, and the explanation of these others is therefore more important. Correspondingly, they are taken up more in detail, and the practical side of their utilization is more fully brought out. Thus, the electric railway is described in all its parts, even to the bonding of the rails, and the series-parallel method of controlling the speed of the motors. It is especially pleasant to note that the author keeps constantly before the reader the practical aspect of the subject, so as to supply him with a healthy basis for thought: For instance, in explaining the dynamo, he points out that power is required to drive the current-bearing armature coils through the magnetic field, and that this power is in precise proportion to the output of the machine. It often happens that a beginner in the study of electricity misses the necessary realization of this truth, and becomes involved in much confusion of thought and loss of time before he learns it.

Nowadays, when so much of electrical mechanism surrounds us in our daily life it is proper that everyone should grow up with a clear, if elementary, understanding of its action. The younger generation is apt to absorb the knowledge necessary for such a comprehension without much study, but a book like the present will be a great help in forming accurate ideas. Many of those who belong to an earlier generation will welcome an opportunity to clear their thoughts on electrical matters. For such the book is written, and in spite of the great mass of electrical literature already existing it is one of the first good books of its kind. The publishers' announcement states that the proceeds of its sale will in large part go to the widow and children of the author, but the book does not need this recommendation; it will find a large circle of readers on its evident merits.

Engineering Astronomy.

A TEXT BOOK OF FIELD ASTRONOMY FOR ENGINEERS.—By George C. Comstock, Professor of Astronomy in the University of Wisconsin. New York: John Wiley & Sons. Cloth; 6 × 9 ins.; pp. 199; tables, 6 plates and 15 figures. $2.50.

This is a most excellent work for the engineer. It offers, first, a compilation of methods for carrying out the fundamental determinations—latitude, azimuth and time—of geodetic surveying; and, second, instructions for conducting computations. These instructions are more or less scattered through the text, and are incidental to the treatment of the main theme, in their application to the computations which the astronomical reductions require. That this feature is not wholly subsidiary, even in the opinion of Professor Comstock himself, may be judged from the following passage in his preface:

> The parts of astronomical practice most pertinent to engineering instruction seem to the author to be (a) training in the art of numerical computation; (b) training in the accurate use of such typical instruments of precision as the sextant and the theodolite, with special reference to the elimination of their errors from the results of observation; (c) determinations of time, latitude and azimuth, with portable instruments, as furnishing subject-matter through which (a) and (b) may be conveniently realized.

Notice that "training in the art of numerical computation" is here put first; and first it should be, for the undergraduate engineering student (and as well the student who has graduated into the active exercise of his profession) is nowhere more deficient and hopeless than in the matter of "figuring." To be able to figure correctly and rapidly is even more essential to the engineer than to be able to write good English—that other ideal in engineering education—for all his work bases on the accuracy of his calculations. In taking up some elementary work in astronomy, therefore, the author takes advantage of the computations involved in the work, and suggests to the student some methods of arranging calculations tending to secure, even in the most intricate cases, a maximum economy in time and labor, and the maximum probability of correct results. As Professor Comstock expresses it, his object is to bring about "the student's acquisition of good habits in the conduct of numerical work."

Looked at from the other side, as a manual of engineering astronomy, the core of the matter is given in five chapters containing selected methods for finding latitude, time and azimuth by portable instruments. These methods were selected from the experience of years in teaching geodetic astronomy to engineers, and in personally carrying out astronomical determinations, and they may be accepted by the engineering profession as being most thoroughly adapted to its special needs. As the preface states,

> while many of the methods given are not contained in the current text-books, in every case these are either methods in use in the best geodetic surveys, or such as have been repeatedly tested with students and found well suited to their use.

Again, in the text of the book itself, the author says, in introducing the presentation of the methods,

> For each of these determinations, time, azimuth, latitude, many methods have been devised and these differ greatly among themselves with respect to the instrumental equipment and expenditure of time and labor which they require, and with respect to the corresponding degree of accuracy furnished in their results. In any given case a choice must be made among these methods with reference to the required precision of the results and also with reference to convenience and economy in obtaining it. To facilitate this choice the methods to be presented in the following pages are classified as
>
> (A) Rough determinations, in which there may be permitted in the final result an error amounting to two minutes of arc, or one-tenth of a minute of time;
>
> (B) Approximate determinations, in which the final errors ought not to exceed 15 and 1 second, respectively;
>
> (C) Accurate determinations, in which the required precision is limited only by the capacity of the instrument and of the observer. In the case of a sextant this limit may be placed at 2 or 3 secs., and for a good engineer's transit at 1 sec.

The remainder of the book is made subservient to the presentation of these methods. This will be apparent from the following synopsis of the contents of the book. The introductory chapter explains some elements of spherical trigonometry and discusses numerical computation; Chap. 2 gives the different systems of astronomical co-ordinates and the transformation formulas; Chap. 3 defines various time systems; Chap. 4, "Corrections to Co-ordinates," treats of dip of horizon, refraction, etc., and gives formulas; Chap. 5, "Rough Determinations," and Chap. 6, "Approximate Determinations," enter upon the main subject. Before going on to precise work, a chapter on "Instruments" is interpolated, in which sextant, level and theodolite are taken up, their possible errors pointed out, and the analytical methods given for correcting the results of calculation for such errors. Chapters 8 and 9 really belong together; the former gives methods for "Accurate Determinations," while the latter discusses "The Transit Instrument" and its use for time and azimuth determinations. A short set of "Orientation Tables" is given at the end of the book, by which the rougher determinations can be carried out without the use of an ephemeris.

This outline of the contents will serve to indicate, at least to the engineer who has to do with orientation observations, that the book is closely adapted to his needs. There are few, very few, publications of any kind covering approximately this ground, but even among such a small company we think Professor Comstock's book deserving of special praise. In conciseness it is the model of a technical book; dealing with a subject so broad that the simplest statement might be expanded almost indefinitely, the author has limited himself closely to what is absolutely necessary for the purpose of the engineer. This is illustrated, as an instance, by the absence of any reference to longitude observations, and again by the fact that the single reference to the chronograph is the following, "but we shall here suppose the observer not to be provided with a chronograph."

It is this conciseness and strict utility of the book which, together with the careful selection of the most suitable methods for the various determinations, constitutes its chief excellence as a handbook of engineering astronomy. A contributory feature that deserves mention is the logical arrangement of the matter, combined with a lucidity of statement which the reader cannot fail to appreciate. That some of the methods described in the book are original with Professor Comstock need only be mentioned here, as its value to the engineer is independent of that fact.

A Satisfactory Book on Heat-Engine Thermodynamics.

THERMODYNAMICS OF HEAT-ENGINES.—By Sidney A. Reeve, Professor of Steam Engineering at the Worcester Polytechnic Institute. New York: The Macmillan Co. Cloth; 5 × 8 ins.; pp. 316 + (The Steam Table) 42; tables and illustrations. $2.60.

Works on thermodynamics are usually composed chiefly of a formidable mass of mathematics, which make their reading almost impossible to any one not well versed in the calculus. The present book is a notable exception. Three quarters of it may be easily read by any one acquainted with steam engine theory and practice, as they are treated in ordinary works, and the remainder contains no more difficult mathematics than simple algebraic equations, with a very few equations involving integrals and differentials and hyperbolic logarithms. The author gets rid of the greater part of the difficulty which students of earlier works meet in attempting to master the subject of thermodynamics by adopting the graphical method of the temperature-entropy diagram, instead of the troublesome analytical method which is followed when the pressure volume diagram only is used.

The first chapter contains a remarkably clear statement of the general principles of energetics, and thermal energy is compared with mechanical, chemical and electrical energy by simple analogies. It is shown that as mechanical energy is the product of two factors, distance and force, which are classed respectively as factors of intensity and extent, so thermal energy is a function of an intensity factor, absolute temperature, and a factor of extent, entropy.

The usual mathematical definition of entropy is given in terms of the calculus, viz.: $d N = d Q \div T$, in which N is the entropy, Q the quantity of heat and T the absolute temperature. The author then attempts to define it "in general terms" as follows:

> Entropy is that quality of a body which increases when heat is added to the body, which decreases only when heat is abstracted from the body, and consequently remains constant only when heat is neither added nor abstracted.

He continues, after giving this definition in italics, to explain further what entropy is. We quote the following sentences:

> Clearly entropy is a dimension of extent. If so entropy must be either mass itself or some function of mass. . . . If entropy be mass . . . the proportion of the mass of the body which takes part in thermal vibration must be variable. . . . There is a variable portion of the mass of each atom which enters into the motion which constitutes thermal energy. This variable portion . . . is the entropy of the body. If not, it is at least an active factor in that entropy.

The author also criticises a definition of entropy that has been given by other writers, thus:

> As to the idea frequently promulgated at present in a manner far too dogmatic to harmonize with one meager knowledge of the truth, viz.: that entropy is a mere mathematical ratio, heat divided by temperature, it is a brief task to point out its untenability. Heat is energy, an eternal, indestructible reality. Temperature is a mere dimension, quite destructible, of that reality. Their natures are quite incompatible. There is no more possibility of a ratio between heat and temperature being nothing more than a ratio than there is of a ratio between area and length being nothing else.

We fail to see that the author has either established his definition "in general terms" of entropy, or brought to the student any mental conception of the physical reality of entropy, if it has any such reality. The definition would be more accurate if the word "entropy" were removed from it and the words "quantity of heat" substituted; but entropy is clearly not a quantity of heat, nor is it clear that it is a quality of a body. It cannot be measured in feet or weighed in pounds, nor conceived of as having any entity cognizable by the senses. Further, the definition does not appear to be consistent with the known fact that when a gas is compressed adiabatically, mechanical work being expended on it, and its temperature and the quantity of heat contained in it thereby increased, the entropy remains constant, and that when a gas expands adiabatically, losing heat which is transformed into mechanical energy, the entropy also remains constant. It does not harmonize with the statement of other writers that when heat passes from one body to another the entropy of the system is increased.

If 1 lb. of water at 0° F., with entropy 0, by Professor Reeve's table, is added to 1 lb. at 212°, with entropy 0.3126, the total heat of the 2 lbs. is not increased, but the entropy is increased to 0.3370, or 2 × 0.1685.

It seems to us that any attempt to define entropy in general terms as an actual entity is bound to fail, for the reason that it is a mathematical function and nothing else. Quantity of heat may be defined as the product of weight, specific heat and temperature, all three of which are determinable by well-known methods of measurement, and the quantity itself is determinable in known terms by the instrument known as a calorimeter. But the quotient of a differential of a quantity of heat by the absolute temperature remains a quotient and nothing else.

The ratio of area to length, in a rectangle, is breadth, which can be measured in feet. The ratio of quantity of heat to temperature is merely a quotient, a mathematical function. It does not seem possible to give any better definition of entropy than the following: (1) If heat is added to a body at a uniform temperature, the increase of the quantity divided by the absolute temperature is the increase of entropy. (2) If heat is added to a body while the temperature increases, and the heat energy added between any two limits of temperature is represented by an area the ordinates of which represent the temperatures, then the abscissa included between the two ordinates corresponding to the initial and final temperatures is a measure of the increase of entropy.

The defect in the author's definition of entropy in general terms, however, does not affect his treatment of the subject in the remainder of the book, for his definition in mathematical terms is the same as that of other writers, and all his further work is practically based on that definition.

The second chapter discusses the "cycle," and the laws of thermodynamics, and clearly shows the losses of efficiency in all cycles which depart from the rectangular one, the rectangle referring to the temperature-entropy diagram. In the third chapter the author treats of the thermal properties of matter. He first considers briefly the molecular vibration hypotheses, which might have been omitted, as they are of no practical value in this place, and then gives a very satisfactory treatment of the subject of the properties of steam. The remainder of the book, which is the larger portion, treats of the steam engine cycle; the laws of the permanent gases; gas and hot-air engines; refrigerating machines, and simple and compound engines. This part of the book is thoroughly practical, clear, and, as far as we have been able to observe, accurate.

The steam tables in the back of the book give the properties of steam, including the entropies of the water, of vaporization and of saturated steam, for every degree of temperature from 32° to 445° F., and for every pound pressure from vacuum to 400 lbs. absolute.

The book is a very valuable contribution to the literature of thermodynamics, and should be read by every student of the subject.

The Slide Valve.

THE SLIDE-VALVE AND ITS FUNCTIONS.—By Julius Begtrup, M. E. New York: D. Van Nostrand Co. Cloth; 6 × 9 ins.; pp. 143; 90 illustrations. $2.

"The slide-valve has been called the heart of the steam engine." It is quite fitting, therefore, that a monograph should be written on the subject, and this book is such a monograph. But although the book is a monograph, no attempt has been made by the author to make the treatment of the subject exhaustive. He has aimed rather to lay down the fundamental principles of slide-valve design, to illustrate those principles by new graphical methods, and to analyze the construction of a number of well-known valves. In brief, the endeavor has been to present the subject matter in a condensed form, "as being best adapted to the requirements of practical men." The first chapter treats of the common slide-valve and the method of its design; while the chapter following describes and illustrates about 15 different improved slide-valves.

Chapter III. is on "four-valve" systems, following which comes a chapter on independent cut-off valves. In this chapter are discussed the Gozenbach valve, the Meyer cut-off, the Rider cut-off, Gridiron valves, Begtrup's eccentric and valve gear, McIntosh & Seymour valves, and others.

Slide-valves on pumps are briefly considered in a 13-page chapter, after which comes the final chapter, also brief, on the angularity of connecting and eccentric-rods.

The monograph may not be quite as comprehensive as one would wish such a monograph to be, but it is certainly all that its author claims for it in his preface. It is written in a style that is perfectly clear, and contains practically no mathematics, the graphical method of analysis being employed exclusively.

The author evidently writes from experience, and his work is in no sense a mere compilation. The book is indexed, but not with good judgment, the index being redundant in having such heads as these: "Face of Valve," "Relation Between Lap and Travel," "Intervening Steam Pressure." The typography is injured by the too frequent use of heavy black type in the body of the text. Where such heavy type is used to bring out a single word or expression which is being defined it is not objectionable; but when used in place of italics, for emphasis of whole clauses, it mars the page and adds nothing to the clearness of the text.

A New Prime Mover.

THE STEAM TURBINE.—By Robert M. Neilson, Assoc. M. Inst. M. E. London and New York: Longmans, Green & Co. Cloth; 6 × 9 ins.; pp. 163; 9 plates and 145 illustrations in the text. $2.50 net.

It is a curious thing how a new departure in mechanics is frequently worked over for years by inventors and experimenters and finds record in many forms in the various national patent offices, before it is finally brought into commercial prominence. The steam turbine is an excellent example of this. It is only within the last two or three years that it has become of commercial importance, and its first application commercially dates back only about a dozen years; but inventors have been at work on the problem since the days of Hero of Alexandria, whose hollow globe rotated by the reaction of steam escaping from jets at its circumference has long been a standard illustration in text-books on physics.

The book before us opens with a chapter on the history of the steam turbine, from which it appears that Hero's turbine was reinvented at intervals down to the beginning of the nineteenth century. The first inventor to apply an impinging jet of steam to vanes or buckets on a wheel was Noble, whose English patent is No. 3,289 of 1809. Trevithick, in 1815, returned to the reaction jet principle in his patent No. 3,922. Among other noted early inventors who worked on the problem and whose work is here described were Ericsson and Perkins. In an appendix the author gives a list of British steam turbine patents up to the end of 1899. The list covers seven pages of the book and we earnestly recommend its consultation by any of our readers who may be considering steam turbine inventions. The author makes no mention of American patents on steam turbines, so we may add for the further encouragement of hopeful inventors in this field that they number over 300.

Coming down to the discussion of present-day turbines, the Parsons turbine naturally receives most liberal treatment; but the De Laval turbine and the Rateau turbine, a French machine, have each a separate chapter.

The theory of operation of the steam turbine is discussed quite fully, and this part of the book, we imagine, will be found useful as a text-book and work of reference in the engineering schools. The concluding chapter gives a brief account of the application of the steam turbine to marine propulsion.

Naturally the entire sum of existing knowledge concerning steam turbines cannot be condensed into a book of this size. There are many practical matters concerning the manufacture and the use of steam turbines which the author does not reveal, and which in fact we presume are pretty closely guarded by the manufacturers. The book is well and concisely written, however, and the information which it does give can hardly fail to be of service to any engineer desiring a treatise on this subject.

Letter Designing.

LETTERS AND LETTERING.—A Treatise with 200 Examples. By Frank Chouteau Brown. Boston: Bates & Guild Co. Cloth; 6 × 9 ins.; pp. 214; 211 illustrations. $2.

This book does not go into the details of construction of certain types of letters like Professor Jacoby's standard work, "Text-Book on Plain Lettering." The only constructive plates shown in the present work are one for Roman capitals, after Sebastian Serlio; one for lower case or "minuscule" Roman letters, by the author; a modern American development of the Roman alphabet, by Will Bradley; and a German Black Letter alphabet, after Albert Dürer.

But the book is lavishly illustrated by well-chosen examples of the styles of lettering that have best stood the test of time—Roman, Gothic, Italic and script. Many complete alphabets are given and many examples of the application of the various types: for sculptural work (such as incised and raised inscriptions); for book covers and titles; for initial letters; and for posters and advertising purposes. The subjects chosen cover all periods from the work of ancient Romans to the best modern design of such artists as Walter Crane, E. H. New, C. R. Ashbee, Edward Penfield and Maxfield Parrish. The text fully explains the numerous examples and gives also a very readable history of letters and their development.

The final chapter, "To the Beginner," gives him some useful hints on tools, materials and methods, and contains some *dicta* that might well be borne in mind by those who have occasion to construct titles for plans and drawings, or to prepare advertisements. The author says, for instance:

Blackness and boldness of stem will not make a letter readable. Width, boldness of hair lines and serifs and *a proper amount of surrounding white space* are more essential.

The Roman letter is more readable than the black letter mainly because it is black against a roomy white ground; while black letter is defined by small interrupted areas of white on a black ground.

The draftsman's first aim should be to make his lettering readable; after this has been accomplished he should strive to give it beauty. Art in lettering is only to be attained by solving the problem of legibility in the way most pleasing to the eye.

Treating and Working Tool Steel.

HARDENING, TEMPERING, ANNEALING AND FORGING STEEL.—By Joseph V. Woodworth. New York: Norman W. Henley & Co. Cloth; 6 × 9 ins.; pp. 288; 201 illustrations. $2.50.

The commendable work of Mr. Woodworth in his book on "How to Construct Dies and How to Use Them in Power Presses," which was reviewed in our issue of Dec. 18, 1902, leads one to examine with interest this work by the same author on a subject of equal practical importance. It may be said at the outset that all the commendation bestowed on the earlier book cannot be repeated without reservation respecting the volume before us. The book is the attempt of a practical man thoroughly familiar with his subject to convey his knowledge to other practical men in concise and clear language. As to the importance of the subject and of the need of more information regarding it the author's own words are the best indication of his views. He says in his preface:

In preparing this treatise the author has had as an incitement the knowledge that there was very little information to be had on the treatment and working of steel of practical value to the general mechanic. For this reason he is convinced that a practical book on the treatment and working of the metal as modern demands necessitate, that is, in regard to heating, annealing, forging, hardening and tempering processes, cannot fail to prove of interest and value to all mechanics who use tools or who are in any way engaged in the working of metals.

When the fact is considered that tools made from the best grades of steel will not perform the work required unless they have been treated properly during the various heating processes, the value of a knowledge of the most satisfactory and approved arrangements and methods to the mechanic is at once apparent.

With the object in view of giving to practical men a book treating and presenting this paramount subject in a clear, concise and practical manner, the author has drawn upon a personal experience of many years, gathered all the information obtainable eliminating all unnecessary and obsolete matter, and added all that is approved, up-to-date and authentic.

It may be justly questioned, we think, whether there is any such great lack of available information on the subjects of his book as the author seems to believe. Indeed, a very considerable proportion of the contents of the book before us is credited by the author himself to other sources of information than his own experience. The characteristic feature of his book is the collection, compilation and arrangement of available material in one place. In performing this task he has included much that could have been better left for the reader to find in the trade catalogues from which it was taken. The bulk of Chapter III., for example, is devoted to the illustration and perfunctory description of gas-blast furnaces and heating machines, all of which is essentially trade catalogue matter. Much the same criticism is true of Chapter XII., on grinding of tools, and of several smaller sections scattered through the book. Another criticism which seems warranted is the uselessness of a large number of the illustrations and their lack of connection with the text, and the random arrangement and want of sequence in the various items of work and the processes described. An elaborate index has been provided, but the work of indexing has been poorly done.

Despite these somewhat obtrusive faults the merits of the book in many particulars cannot be denied. It contains a vast amount of useful information on the subjects treated.

Original Research on the Shrinkage and Strength of Cast Iron as Affected by Various Elements.

CAST IRON.—A Record of Original Research.—By William J. Keep. New York: John Wiley & Sons. Cloth; 6 × 9 ins.; pp. 225; 80 tables and 117 illustrations. $2.50.

This book is exactly what its title indicates, and it is perhaps not saying too much to add that it contains the most comprehensive discussion of cast iron and its "alloys" with carbon, silicon and phosphorous, that has yet appeared in the English language.

The author has drawn very largely from the data accumulated by him as a member of the American Society of Mechanical Engineer's Committee on Standard Tests and Methods of Testing Materials. To him the foundry world is indebted for the shrinkage (or Keep) test for determining the percentage of silicon in cast iron.

Professor Turner in his "Metallurgy of Iron and Steel" says regarding cast-iron shrinkage:

The subject has been carefully investigated by W. J. Keep, of Detroit, whose experiments embody the whole of the trustworthy data available.

The large number (80) of strength and shrinkage tables, most of which are based directly upon the author's experiments, indicates somewhat the extent of his original research.

In separate chapters the effect of varying percentages of carbon, of silicon, of phosphorous, of sulphur, of manganese and of aluminum are discussed. Then, in a final chapter, the effect of certain metals (Ni, Fe, Cu, Zu, Sn, Pb, and Cr) is given briefly in tabular form.

To Mr. Keep also is due the credit of having discovered the curve of shrinkage of cast iron upon cooling, thereby proving the curve is not a regular one.

Both from the viewpoint of the engineer and the founder this book should prove to be a most useful source of original information as to the strength and shrinkage of cast iron under varying conditions.

ENGINEERING STUDIES.—By Charles Evan Fowler, M. Am. Soc. C. E. Part I., American Stone Arches, pp. 15; Part II., Roman Stone Arches, pp. 14; Part III., English Stone Arches, pp. 14; Part IV., French Stone Arches, pp. 14; Part V., German and Austrian Stone Arches, pp. 16. Engineering News Pub. Co., New York. Paper; 7 × 10½ ins.; illustrated; 25 cts. each part.

The object of the author in this series of "studies" is to present photographic views of well known and important engineering structures, such as arches, bridge piers, approaches, towers, and tunnel portals, accompanied by short descriptions in which the faults and merits of the structure as a work of art are pointed out. The five parts so far published illustrate notable stone arch bridges. The illustrations are half-tone engravings from photographs, and are about 7½ × 4½ ins. in size, each occupying a separate page. The text is concise and gives all the information needed to meet the purpose of the book. Parts IV. and V. are new; the others were published some months ago.

RULES FOR RAILWAY LOCATION AND CONSTRUCTION USED ON THE NORTHERN PACIFIC RAILWAY.—By E. H. McHenry, M. Am. Soc. C. E., Chief Engineer No. Pac. Ry. Co., 1893-1901, now Chief Engineer Can. Pac. Ry.; With an Additional Chapter on Estimating Overhaul in Earthwork. By H. P. Gillette. New York: Engineering News Publishing Co. Cloth; 5 × 7½ ins.; pp. 88; illustrated. $1.

The first edition of this work appeared four years ago. This new edition contains a revision of the first, and a new chapter, or rather appendix, on Estimating Overhaul in Earthwork.

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A German Engineer's Handbook.

DES INGENIEURS TASCHENBUCH.—Herausgegeben vom Verein Hütte. Eighteenth Edition. Revised. Flexible Leather; 5 × 7 ins.; two volumes; pp. 1,199 and 867; 934 and 492 illustrations. Berlin: Wilhelm Ernst & Son.

This compilation is designed to serve the same purpose in Germany as do the several civil and mechanical engineers' pocket-books current in America. In its 18th edition it represents a complete revision, and the list of collaborators given in the preface includes the foremost engineering and technical authorities in Germany. New chapters have been added as follows: Water Supply, Sewerage, Road Construction, and Bridge Construction. The 2,000 pages of the work, representing an increase of some 300 pages over the preceding edition, make it probably the largest of engineering "pocket-books"; in fact it is far beyond the limits of a pocket-book, and can serve only as a desk manual, each of the two volumes being about the size of our "Trautwine." The size is due partly to the use of larger type than is used in American pocket-books, but principally to the greater amount of matter. The main subjects treated, and the number of pages given to each, are as follows:

Vol. I.—Mathematics, 130; Mechanics, 130; Heat and Thermodynamics, 70; Mechanics of Materials, 100; Properties of Materials, 120; Details of Machinery, 180; Prime Movers, 245; Machines, 120.

Vol. II.—Surveying, 50; Building Construction, 50; Water Supply, 34; Sewerage, 12; Heating and Ventilation, 32; Road Construction, 30; Statics of Structures, 92; Bridge Construction, 36; Ship Building, 104; Railroads, 204; Metallurgy of Iron, 22; Electrical Engineering, 116; Gas Making, 22; Miscellaneous Appendix.

There is much in the work that would probably not be included in a similar American compilation, as being too infrequently used to make it worth the space. On the other hand, very much is given that might be included in our American pocket-books. The free use of formulas, and, generally, of mathematical expression is commendable. The typography is clear, and the cuts excellent, and the large size of type (this is roman, not gothic) makes it much less trying to the eyes than the smaller type often used in pocket-books. American engineers should find this work worth a place on their reference shelves.

Three Indexes.

SUBJECT-MATTER INDEX OF MINING, MECHANICAL AND METALLURGICAL LITERATURE FOR THE YEAR 1900.—M. Walton Brown, Editor. Newcastle-Upon-Tyne: North of England Institute of Mining and Mechanical Engineers. Paper; 6 × 9½ ins.; pp. xxiv + 197. 42 shillings in England; $16.80 in America.

This might more properly be called a classified bibliography instead of a subject-mattter index, for the term index is now so rarely used to indicate a mere class-grouping of references that whenever one sees the word an alphabetical arrangement is expected. If there is any alphabetical arrangement here it is by accident, and as a consequence what otherwise appears to be a painstaking and exhaustive piece of work loses, or has never had given to it, a large part of its possible value. The main subjects covered are geology, mineralogy and crystallography, chemical and physical investigations, surveying and leveling, mining and quarrying technology, metallurgy, salt-works, chemical industries, ceramic and glass industries, building construction and materials, machinery, electrical investigations, navigation, surface transport, railways and tramways, administration and statistics, and directories. These twenty subjects are arranged in the order named, and each is further subdivided, and in some instances divided again, but neither the subdivisions nor the several entries under any of them are arranged alphabetically. Many of the subjects have their main subdivisions split up by countries, and by separate States within those countries. Under "Machinery" we find "Water Reservoirs," and under it are given: (a) general; (b) reservoirs; (c) water-works; (d) filtration; (e) pipes and fittings; (f) irrigation; (g) gages and meters. But garbage disposal, sewerage, and water purification come under sub-head (13) "Sanitation and Diseases of Workmen," under subject (XIX.), "Administration and Statistics." To learn the foregoing facts regarding the location of the topics "indexed" one must look through a "Contents" of 17 pages. Surely this "Index" itself needs an index. At the close of the "Subject-Index" there is a properly arranged alphabetical index to authors, with page references only. This might be of material assistance in some cases, but in the majority of instances it would be of no help to any one wishing references to specific topics. A minor difficulty in using the book is the fact that for every reference given one must consult a key to learn the name of the journal or other publication; thus a reference to Engineering News would be 325 (in heavy faced type) XLIII., 250.

The number of journals, society and government reports included in the "Alphabetical List of Publications Indexed" is large, the total number of references is enormous, and save for the lack of proper arrangement the work appears to deserve high praise. But this lack, combined with the excessive price (42 shillings in England for a single year), precludes all possibility of anything but a very limited sale in this country. Happily both drawbacks may be easily remedied in future issues.

GENERAL INDEX OF THE PROCEEDINGS OF THE UNITED STATES NAVAL INSTITUTE.—By Lieut. Edward L. Beach, U. S. N., Secretary. Part I. Index of Authors with their Writings. Part II. Index of Contents. Part III. Index of Contents Classified Under General Headings. Part IV. Contents of Volumes by Numbers in Consecutive Numbers, Nos. 1 to 100 (1874 to 1901, inclusive). Part V. List of Prize Essays and Prize Essayists. Baltimore, Md.: The Institute. Paper; 6 × 9 ins.; pp. 266.

Convenient as Parts I. and II. of this Index may be, it seems questionable whether they are worth the labor and expense which they have cost; or to put it otherwise, whether the same time and money might not have been more profitably put upon sub-indexing the several articles. It is true that the general classification in Part III. is different from that in Part II., but the possible value of this part is largely nullified by arranging the several entries alphabetically by their exact titles. Thus under "Historical" there are 32 entries, beginning with "The." Most of the headings, however, do not contain so many entries as to require more than an instant to glance through them. The Index as a whole is a valuable piece of work.

LIST AND CATALOGUES OF THE PUBLICATIONS ISSUED BY THE U. S. COAST AND GEODETIC SURVEY, 1816-1902.—By E. L. Burchard, Librarian. Washington: Address the Survey. Cloth; 8 × 12 ins.; pp. 239.

The List is arranged by years, in order of publication, giving first the annual reports, with synopses of their contents, and next the publications issued separately. The Catalogue includes both a subject and author index of the publications, and the titles of papers are repeated in the author index. The main subjects covered by the publications of the survey, as shown by this Catalogue, are as follows: Geodesy, Hydrography, Topography, Terrestial Magnetism, and Chart Construction. Under "Allied Subjects" we find: Mathematics and Computation; Physics; Standards; Geography; Geo-Physics, and Engineering. All the publications of the survey, except those out of print, and the Coast Pilots and Tide Tables, may be obtained free of charge by addressing the Superintendent, at Washington. The Coast Pilots and Tide Tables are "sold at the cost of paper and printing."

ON THE STRESSES DEVELOPED IN BEAMS LOADED TRANSVERSELY.—By Henry T. Bovey. Paper; 6½ × 9½ ins.; pp. 28; tables and illustrations.

This pamphlet is reprinted from Vol. VIII., Sec. III. of the Transactions of the Royal Society of Canada, and contains further results obtained with the new extensometer described in Section III. of Volume VII. of the Transactions of the same society. The pamphlet is for sale by J. Hope & Sons, Ottawa, and The Copp-Clark Co., Toronto, Canada.

RAINFALL NOTES, NOVA SCOTIA.—By F. W. W. Doane, M. Can. Soc. C. E., City Engineer, Halifax, N. S. From the Transactions of the Nova Scotia Institute of Science. Vol. X., Session, 1900-1. Paper; 6 × 9 ins.; pp. 10; tables.

Details are given of the rainfalls at Halifax, Truro, Sydney and Yarmouth, in 1900, and also figures for the years 1869 to 1900 for Halifax. The latter includes the monthly and annual precipitation, and also the amount from Jan. 1 to the end of each month of the year.

PROCEEDINGS OF THE SOCIETY

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"Laboratory Notes and Reports," Francis C. Caldwell.

"Alleged Mistakes in Engineering Education and their Remedy," Arthur N. Talbot, Carl Leo Mees.

The Report of the Committee on Technical Books for Public Libraries. C. F. Burgess, Chairman.

"Courses of Instruction in Irrigation Engineering," Elwood Mead.

"Electrochemistry as an Engineering Course," C. F. Burgess.

"The Subdivision of the Field of Chemical Engineering," Edward Orton, Jr.

"Some Abuses of the Lecture System," A. W. French.

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"Excessive Differentiation of Engineering Courses; a Symposium." Edgar Marburg, Calvin M. Woodward, Wm. T. Magruder, C. Frank Allen.

Report of the Committee on the Statistics of Engineering Education, Wm. T. Magruder, Chairman.

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Index, Vol. X. and Index to Combined Volumes I. to X.

Index to Combined Vols. I. to X.

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AMERICAN PARK AND OUT-DOOR ART ASSOCIATION.—Proceedings of the Boston meeting, 1902. Chas. M. Robinson, Secretary. Paper; 6 × 9 ins.; pp. 86, and 47. Rochester, N. Y.: Address the Secretary. 25 cts. each (for extra copies to members).

This association prints its proceedings in sections, in order, it is said, to hasten their publication. The first section contains the reports of the various officers and committees, including among the latter an interesting report of the Park Census Committee. It also includes a number of addresses from invited representatives of other organizations devoted to municipal affairs. A praiseworthy resolution was adopted looking to some kind of federation of such bodies as the National Municipal League, the American Society of Municipal Improvements, the American League for Civic Improvement, and the American Park and Out-Door Art Association. The second section includes a portion of the papers and addresses at the Boston meeting, and is to be followed by a third section. The addresses printed herein are as follows: "Popular Utilization of Public Reservations," by Dr. Charles W. Eliot, President of Harvard University; "The Influences of Beautiful Surroundings on Children," by Rev. J. N. Hallock, D. D.; "State Forest Reservations, with Special Reference to those of Pennsylvania," by Mira Lloyd Dock; "Water an Effective Factor in Municipal Art," by Albert Kelsey; "Civic Improvement Work," by John De Witt Warner; "The Forward Movement in Harrisburg," by J. Horace McFarland; "Public Beauty and Good City Government," by Clinton Rogers Woodruff.

THE HARDY CATALPA.—Bulletin 37, Bureau of Forestry, U. S. Department of Agriculture, Gifford Pinchot, Forester. I. Commercial Plantations. By Wm. L. Hall, Superintendent of Tree Planting. II. Diseases. By Hermann von Schrenk, Pathologist in Charge Mississippi Valley Laboratory, Bureau of Plant Industry. Washington: Pub. Doc. Paper; 7 × 10 ins.; pp. 58; tables, 30 plates and 2 figures in the text.

All interested in the threatened exhaustion of the timber supply of the country, in the rapid production of posts, railway ties, and telegraph poles, and in either private or public forestry, can scarcely fail to find this handsomely illustrated bulletin of interest and value. The growth of the catalpa is phenomenal, so that it, unlike most species of trees, promises a commercial return within the lifetime of a man already well towards middle life. But although nature does so much for man in the way of rapid growth, man can assist greatly by proper cuttings and trimmings of the catalpa. This bulletin tells how this has been and may be done, and also how to combat the diseases to which the tree is subject.

NEW JERSEY STATE SEWERAGE COMMISSION.—Report for 1901-2. Boyd McLean, Secretary, Jersey City, N. J. Paper; 6 × 9 ins.; pp. 51; tables and pocket map.

The routine work of the board, consisting of investigating complaints and issuing orders as to stream pollution by sewage, and approving plans for new sewer outlets and works for sewage treatment, is outlined in this report. There is included a report by Thos. Le Clear, of New York city, on bacterial and chemical analyses of crude sewage, septic tank and contact bed effluents from Plainfield, N. J., and also an abstract of the most recent report by Prof. Frank Clowes on the bacterial treatment of crude London sewage.

SLOW-BURNING OR MILL CONSTRUCTION.—Insurance Engineering Experiment Station, 31 Milk St., Boston, Mass. Report No. V. Paper; pp. 16, with folding plates; 25 cts.

None of the numerous reform movements in which Mr. Edward Atkinson has ever engaged has held greater possibilities for public benefit or has achieved a larger success than his work for the better and safer construction of American factory plants. Every well-informed engineer and architect nowadays ought to be familiar with the general principles of the slow-burning mill construction as it has been developed by many years' experience. Any engineer who is not thoroughly posted concerning it, or who has not in his library available for reference the recent data concerning it, cannot make a better investment of a quarter than to send for a copy of this pamphlet.

The plates show typical plans, elevations and details of mills and factories of different styles, built according to this system of construction; and form the most valuable feature of the pamphlet. A table of weights of merchandise for computing safe floor loads and a table of the discharge of pipes will be a valuable addition to engineers' notebooks.

Mr. Atkinson terms the prevalent type of wooden construction in the United States "combustible architecture," and his statistics of the destruction by fire of public buildings in the United States is as severe an indictment of this class of construction as could be framed. We may note here that the average weekly destruction by fire in 1901, according to official reports, showed 12 churches, 10 schoolhouses and 26 hotels.

TRADE AND TECHNICAL EDUCATION.—Report of the U. S. Commissioner of Labor, 1902. Carroll D. Wright, Commissioner. Washington: Pub. Doc. Cloth; 6 × 9 ins.; pp. 1,333.

Technical education as here used excludes all engineering and other professional studies leading to a degree, but includes textile and similar schools where scientific instruction extending over a full four-year period is given. In short, the volume is chiefly devoted to schools designed to replace the old apprentice system. The United States, Austria, Belgium, Canada, France, Germany, Great Britain, Hungary, Italy and Switzerland are taken up in succession, but in detail.

For the United States the main subdivisions are: Building and mechanical trades, brewing, dairying, dressmaking, millinery, domestic training, textile industries, watchmaking, engraving, barbering, drawing, and designing. Besides these, Y. M. C. A., correspondence, and Southern industrial schools are treated. In a separate chapter there is a discussion of the "Attitude of Employees, Graduates of Trade and Technical Schools, and Labor Unions in the United States Towards Trade and Technical Education." Other countries are taken up in much the same way, but generally there is only one chapter to a country. The report promises to be of great value to educators and sociologists, as such, and also to the rapidly increasing number of employers of labor who are actively bestirring themselves to improve the capacities and conditions of their employees, both for commercial and humanitarian reasons. We hope to give the volume more attention in Engineering News at some future time. Colonel Wright acknowledges the assistance of Messrs. Wm. F. Willoughby and Edward W. Bemis in collecting and preparing the portions of the report relating to foreign countries, and to Mr. G. W. W. Hanger, Chief Clerk of the Department of Labor, and Messrs. Chas. H. Verrill and G. A. Weber for aid in preparing and editing the material collected.

U. S. COMMISSIONER OF EDUCATION.—Report for 1900-1, Vol. I. Wm. T. Harris, Commissioner. Washington, D. C.: Pub. Doc. Cloth; 6 × 9 ins.; pp. cxli. + 1,216; tables.

Among the many papers in this voluminous report the following seem most likely to interest our readers: "American Industrial Education," being the preliminary report of a committee of the Society for the Promotion of Engineering Education, submited in 1900; two papers on "Educational Training for Railroad Service," by Professors L. P. Breckenridge and Edw. C. Schmidt, of the University of Illinois, both of which were read before the St. Louis Railway Club; and a review of higher commercial education at various colleges in the United States. The report also contains an educational directory which includes a list of the presidents of schools of technology.

REPORT OF THE CHIEF OF THE U. S. WEATHER BUREAU, 1901-2.—Willis L. Moore, Chief. Washington: Pub. Doc. Cloth; 9 × 12 ins.; pp. xxv. + 342; tables and charts.

This report consists mainly of tables of meteorological observations for the various stations reporting to the Bureau. Eight pages are devoted to excessive rainfalls in 1901, including "the accumulated amounts of precipitation for each five minutes during all storms of 1901 in which the rate of fall equalled or exceeded 0.75-in. per hour, at stations of the Weather Bureau provided with Self-Registering Gages."

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CONGRES INTERNATIONAL DE TRAMWAYS ET DE CHEMINS DE FER D'INTERET LOCAL (International Congress of Street Railways and Light Railways).—Brussels: Union International de Tramways. Paper; quarto; pp. 270.

The "Union" holds a "Congress" or convention every two years, and the present volume (in French) contains the report of the convention held in London in July, 1902. The several subjects to be considered are assigned to certain members or "reporters," who prepare individual papers on these subjects, the papers being based upon or supplemented by information obtained from various members of the society. The volume before us contains not only these papers and the discussions, but also the remarks made by the "reporters" in introducing their subjects, the papers being printed in advance of the meeting so that they do not need to be read. The principal subjects are as follows: (1) Transfers; (2) basis for calculating the power of motors and generators, with the rules of the German Society of Electrical Engineers for the manufacture and test of such apparatus; (3) relations between number of passengers and seating accommodation; (4) power station plants; (5) payments for franchises; (6) the location of car sheds; (7) methods of traction; (8) brakes; (9) narrow and standard gage

for local lines; (10) mail, baggage and express service on street railways; (11) methods of heating cars; (12) proposed uniform accounting system.

CHICAGO ENGINEERING TRANSPORTATION PROBLEM.—Report on the Engineering and Operating Features Submitted to the Committee on Local Transportation of the Chicago City Council. By Bion J. Arnold. Chicago: Address the Committee. Paper; 6 × 9 ins.; pp. 310; folding plates, illustrations in the text, and separate envelope of folding maps.

A full digest of this report, in the form of a preliminary report or summary by Mr. Arnold himself, was published in Engineering News for Jan. 1, 1903. The full report contains an interesting study of the growth of population, street railway traffic and earnings, illustrated by diagrams, and takes up the various technical problems involved in providing unified street railway service for Chicago. It is safe to say that the report as a whole is one of the best studies of the transportation problem of a great city which has ever been made.

REPORT OF THE ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Secretary, Charles McEniry, Cedar Rapids, Ia. Paper; 6 × 9 ins.; pp. 158.

This comprises the proceedings of the 20th annual convention, held at Milwaukee in September last, and a report of which was published in our columns at the time. The several papers and committee reports, with their discussions, are given in full, as well as the general business proceedings of the convention. The principal subjects dealt with are as follows: (1) Education of Young Men as Section Foremen and Discipline of Section Men; (2) Track Jacks; (3) Fences and Cattleguards; (4) Ties, Tie-Plates and Tie Preservation; (5) New Appliances for Maintenance of Way; (6) Curving Rails; (7) Track Drainage; (8) The Catalpa Tree for Railway Plantations.

PROCEEDINGS OF THE RAILWAY SIGNALING CLUB. —Published by the Club, 32 Park Place, New York. Paper; 6 × 9 ins.; pp. 104; illustrated.

This volume contains the proceedings of the meetings held during 1902. The principal papers and discussions are on the following subjects: "Time Locks for Interlocking Plants," Charles Dunham; "Interlocking Construction and Specifications," C. O. Tilton; "Good Practice in the Use of the Distant Signal," W. H. Elliott. There are also committee reports on the following subjects: "Compensators," "Power Operation of Interlocking Plants," "Cost of Wire and Batteries for Line Circuits," "Signal Circuits," and "Organization of the Signal Department."

RESOURCES OF BRITISH COLUMBIA.—Bulletins Nos. 7 and 9, of the Bureau of Provincial Information, Victoria, B. C. Paper; 6 × 9 ins.; pp. 76 and 50, respectively.

Bulletin No. 7 is entitled "General Review of Mining in British Columbia," and gives an excellent summary of mining resources, the output of individual camps, the geological formation so far as known, etc.

Bulletin No. 9 is entitled "The Undeveloped Areas of the Great Interior of British Columbia," and contains a sketch map made in 1899. This bulletin treats of the farming and pasturage lands as yet unoccupied, and gives practically all of the little that is known about the "Great Interior" as to climate and topography.

OPERATIONS AT RIVER STATIONS, 1901.—Part I., East of Mississippi River. No. 65, Water Supply and Irrigation Papers, U. S. Geological Survey, Washington, D. C.: The Survey. Paper; 6 × 9 ins.; pp. 334; many tables.

The information given in this paper ranges from daily gage heights for the whole or a part of 1901 to daily runoffs for a series of years. In some cases the figures for 1901 are given in terms of cubic feet per second, instead of mere gage heights. A large number of streams are included, and references are made to other records than those here published, some of which are in previous papers or reports of the survey. The text gives brief descriptions of the various streams, sometimes including water power developments. This paper will be followed by one for the balance of the United States, besides which there will be a separate publication, in another series, giving general conclusions drawn from the river observations. We are pleased to note that instead of publishing these gagings in three separate papers of one-hundred pages each, with others to follow for the balance of the country, the Survey is bringing all the gagings into two volumes. This is in accord with a suggestion in the last issue of this Supplement, but it appears that the change of plan was decided upon long ago. It is a further pleasure to add that these stream records are increasing rapidly in number and usefulness, and, like the topographic survey sheets, are filling a want that could not be met in any other manner.

MINERALS OF TEXAS.—By Frederic W. Simonds, Ph.D. Bulletin No. 5, December, 1902, of the University of Texas (Austin) Mineral Survey. Paper; 6 × 9 ins.; pp. 104.

This bulletin gives an alphabetical list of all the known minerals of Texas, together with the locality where each mineral is found, its chemical composition and physical properties. Nearly 190 minerals are listed, from which it is evident that the bulletin is what it purports to be. At the end of this bulletin there is a summary of the minerals of Texas by counties. The bulletin has evidently been compiled with care, and should be of value to all interested in minerals, especially those of Texas. It is stated that 19,000 copies of Bulletin No. 4, "The Quicksilver Deposits of Brewster County," have been distributed, and that no more are in print.

IOWA ENGINEERING SOCIETY.—Meeting Held at Davenport, Ia., Jan. 16 to 19, 1903. Secretary (at present), W. H. Jackson, Des Moines, Ia. Paper; 6 × 9 ins.; pp. 114; illustrated. 50 cts.

This belated report contains among other things papers on "Village Water-Works of Iowa and Minnesota," by W. H. Jackson; "Electric Lighting in Small Cities," by G. W. Bissell; and "The New Plant for Increasing the Water Supply of Rockford, Ill.," by Daniel W. Mead. The presidential address, by Prof. Anson Marston, of Ames, Ia., was an interesting review of "Engineering in Iowa."

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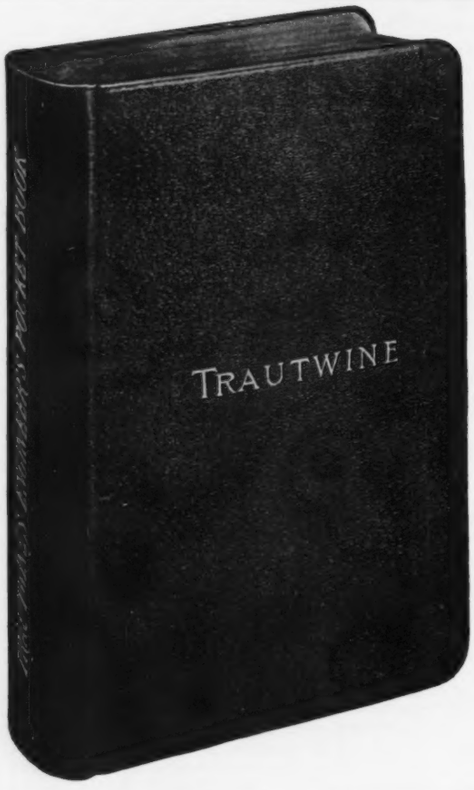

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THE JOURNAL OF THE IRON AND STEEL INSTITUTE, Vol. 62.—London and New York: Spon & Chamberlain; Cloth; 6 × 9 ins.; pp. 648; illustrated.

This volume contains the transactions of the Institute at its Düsseldorf meeting, 1902, at which meeting the following papers were read:

"Progress and Manufacture of Pig Iron in Germany Since 1880," by W. Brügmann; "Progress in Steelworks Practice in Germany Since 1880," by R. M. Dallen; "The Overheating of Mild Steel," by E. Heyn; "Iron and Steel at the Düsseldorf Exhibition, 1902," by Hermann Wedding; "The Compression of Steel by Wiredrawing During Solidification in the Ingot Mold," by H. Harmet; "The Application of Electric Power in the Iron and Steel Industries," by D. Selby-Bigge; "The Use of Electricity in Iron and Steel Works," by F. Kylberg; "Results Obtained in Equalizing the Temperature of Hot Blast," by L. F. Gjers and J. H. Harrison; "The Probable Existence of a New Carbide of Iron, Fe^2 C," by E. D. Campbell and M. B. Kennedy.

Of these papers that by L. F. Gjers and J. H. Harrison was given in full in our issue of Oct. 2, 1902; that by W. Brügmann was also given in full in our issue of Sept. 17, 1902; and that by H. Harmet was given in abstract in our issue of Oct. 2, 1902.

The last part of the volume (pp. 236) is devoted to brief abstracts of all the leading articles of the year relating to iron ores and mining, refractory materials, coal, coke, oil, gas, pig iron and steel. In addition to this, iron statistics of all the countries in the world are given. In fact this last part of the volume always has been and still is of exceedingly great value to everyone interested in the literature of the subjects treated.

THE WEALTH AND PROGRESS OF NEW SOUTH WALES, 1900-01. By T. A. Coghlan, Hon. F. S. S., Statistician New South Wales. Thirteenth issue. Sydney, N. S. W. Boards; 5½ × 8½ ins.; pp. 1,043; map.

This excellent review of progress in New South Wales follows the lines laid down in the preceding issues, treating of every material interest separately and most exhaustively under nearly thirty heads. Taking up the chapter on Internal Communication, as an example, we find that the first railway in New South Wales was opened for traffic in 1855, on a line from Sydney to Parramatta. Up to 1875 the railway lines in operation aggregated only 435 miles, but in June, 1901, a total of 2,845 miles were open to traffic. As showing the comparative railway status of the separate states of Australasia, the following is the mileage of line open in each state in June, 1901, including a total of 1,018 miles of private lines: New South Wales, 2,930; Victoria, 3,238; Queensland, 2,856; South Australia, 1,901; Western Australia, 1,978; Tasmania, 594; New Zealand, 2,300 miles. This is a total of 15,797 miles of railway for Australasia. The 2,845 miles of railway in New South Wales cost $58,455 per mile as an average, the maximum and minimum prices per mile being $1,211,195 and $9,510. The gross earnings of these state railways in 1901 amounted to $17,868,895, with a proportion of 57% of working expenses to gross earnings. The established policy of New South Wales is the state management and control of both railways and tramways. Of the latter, there were six distinct systems in operation, aggregating nearly 80 miles in length, and all but one operated by electricity—one two-mile line is operated by cable. The average cost of these tramways per mile was about $138,500, including equipment, or $90,000 per mile for construction. In 1901 these tramway lines showed net earnings of $446,015, with working expenses of $2,312,375. There are now 14,065 miles of telegraph line open, with 41,494 miles of wire, and 414 miles of wire under construction; there were also 12,197 telephones in service, largely connecting with the telegraph system. The report goes fully into the water supply and sewerage of the principal cities and districts, as well as the lighting of these cities by gas and electricity, and their street construction. The census of 1901 gives to New South Wales a population of 1,359,133, with a total population of 3,781,537 for Australasia, excluding New Zealand, with 772,719 people. New South Wales contains 36% and Victoria 32% of the total population.

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LES MACHINES A VAPEUR.—By Gabriel Eucle. Paris: Ch. Dunod. Paper; 9½ × 12½ ins.; pp. 304; illustrated.

This volume forms a special number of "La Mecanique," and is one of the special numbers of that journal which have been devoted to the mechanical exhibits at the Paris Exposition of 1900. The exhibits of the steam engines at the Exposition were of rather uneven quality and this condition is of course reflected in the book before us. The author describes each engine in some detail, giving views and details of special parts and enumerates the principal dimensions.

Publications Received.

ELECTRICITY AS APPLIED TO MINING.—By Arnold Lupton, M. Inst. C. E., M. Inst. M. E., M. Inst. E. E.; G. D. Aspinall Parr, M. Inst. E. E., Assoc. M. Inst. M. E.; and Herbert Perkin, M. Inst. Mining Engr. London: Crosby, Lockwood & Son. New York: D. Van Nostrand Co. Cloth; 6 × 9 ins.; pp. 280; 171 illustrations. $3.50 net.

ENGINEERING CONTRACTS AND SPECIFICATIONS.—Including a Brief Synopsis of the Law of Contracts and Illustrative Examples of the General and Technical Clauses of Various Kinds of Engineering Specifications. Designed for the use of Students, Engineers, and Contractors. By J. B. Johnson (late) Dean of the College of Mechanics and Engineering, University of Wisconsin. Third edition; revised. New York: Engineering News Publishing Co. Cloth; 6 × 9 ins.; pp. 596. $5.

DESCRIPTIVE GEOMETRY.—With Numerous Problems and Practical Applications. By William S. Hall, C.E., Professor of Graphics and Mining in Lafayette College, Easton, Pa. New York: D. Van Nostrand Co. Cloth; 6 × 9 ins.; pp. 76, also 12 × 17-in. portfolio, with 12 pp. of text and 18 plates. $3.50 net.

COMPRESSED AIR INFORMATION—Or a Cyclopedia Containing Practical Papers on the Production, Transmission, and Use of Compressed Air. Edited by W. L. Saunders, M. Am. Soc. C. E. New York: Compressed Air. Cloth; 6 × 9 ins.; pp. 1,175; 49 illustrations.

GEOLOGIC FOLIOS. No. 82—Masontown—Uniontown, Pa.; No. 84—Ditney, Ind. Washington, D. C.: U. S. Geological Survey; 18 × 21 ins.; pp. 22 and 9, respectively; maps and illustrations; each, 25 cts.

The Current Literary Magazines.

"The Overshadowing Senate" is the title of a paper by Mr. Henry Loomis Nelson in the February "Century" which deserves most careful reading by every one interested in the problems of our national government. Mr. Nelson maintains that the Senate is the most powerful body in the national government. It controls legislation and it controls also the executive functions of the government. "The Senate has slipped out of its orbit and is describing a larger arc in the political heavens than that which the fathers marked out for it," says Mr. Nelson, and he describes in a graphic way the remarkable extent to which that body has usurped powers which do not belong to it. He makes a good case against the "rich man's club" at Washington; but he fails to point out any means by which its powers may be curbed Perhaps the election of senators by popular vote would do something to remedy the evil. But this remedy is not yet in sight, and the people have the remedy in their own hands after all by electing to their state legislatures candidates who can be trusted to select only worthy and upright men to represent the state in the Senate.

Another interesting paper on a kindred topic we find in the current "Scribner," where Mr. Jas. F. Rhodes describes the Presidential office and the

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extent to which its various incumbents have brought it into honor or the reverse.

In the February "World's Work," among numerous articles which may attract the attention of the engineer, we may mention a description of an American watch factory where over 11,000,000 watches have been manufactured, and in which 3,150 employees are now at work; a paper on "The New Navy at Work," by Lieut.-Commander Albert Gleaves; and "Trolley Lines in a Railroad System," by Sylvester Baxter. The last named paper describes the work of the Boston & Maine Railway Co. in the operation of electric street railway and interurban lines in its territory. A paper on German business methods in the same magazine contains one pregnant sentence which is worth quoting just at this time when Congress is congratulating itself on having done something to appease the popular demand for trust legislation—or anti-trust legislation:

> The Germans consider it rather ridiculous that the various states of our Union have such widely different laws and that the inhabitants of a state find it so easy to evade their own laws by forming their companies in neighboring states. It seems strange from the German point of view for Americans to demand a strict control of the trusts while they are perfectly contented with inadequate corporation laws under which unscrupulous promoters can hoodwink the public.

In the "Review of Reviews" for February Prof. John R. Commons describes some interesting experiments in methods of taxation and assessment. Many of the readers of Engineering News may remember the account of the appraisal for taxation purposes of the railways and other corporation property in Michigan, made under the direction of Prof. E. L. Cooley, M. Am. Soc. M. E., published Dec. 20, 1901. The assessed valuation of the Michigan railroads, Professor Commons says, is $208,212,500, and they paid in 1902 about double the taxes paid in 1901. "The Coal Deposits of the Northwest" is the title of an interesting paper in the same magazine by Frank A. Wilder, of the North Dakota Geological Survey. While the coals of the Northwest are inferior in quality to those of the East, they are nevertheless of great economic value, and their enormous extent will make them of the greatest importance in the development of this region with its severe winter climate. Ten years ago the lignite deposits of the Dakotas were considered almost worthless. Now their great value is everywhere recognized. During the present winter about 400,000 tons of Dakota lignite will be sold at an average price of $1.30 per ton at the mine. Still another "Review of Reviews" article worth at least a mention here is "The Present Status of Wireless Telegraphy," by A. F. Collins. Neither may we omit mention of the excellent tribute to the late Abram S. Hewitt by Mr. E. M. Shepard.

Some interesting reminiscences of the early days of Boston commerce are told in the February "Atlantic." It has very likely been forgotten that it was the "Columbia," a Boston trading ship, which was the first American vessel to circumnavigate the globe. She sailed from Boston Sept. 30, 1787, and went around the Horn and thence to the northwest coast of North America. Here a rich cargo of furs was taken and carried to China, where it was sold, and a cargo of tea taken in its stead, which was brought safely home to Boston round the Cape of Good Hope, reaching the home port in August, 1790, having been gone nearly three years. It was this same vessel which on her second voyage to the northwest coast discovered the river to which the vessel's name was given, and, far more important, it was the discoveries made on this voyage, together with the explorations of Lewis and Clark in the next decade, on which the United States based its successful claim to the Oregon territory.

Turning to the English reviews for January we find in the "Nineteenth Century" an article on "The Price of Food in Our Next Great War," in which one gets a glimpse of the reasons which influence England and the nations of the continent in their enormous expenditures for armaments. England groans under the burden of her vast navy, but she goes on increasing it as a necessity to her national safety. Before we in the United States attempt to outdo the nations of Europe in the production of fleets of war we ought to understand the conditions which lead them to such expenditure, and seriously inquire whether we are really under a like compulsion.

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